SUSPENSION FORK
Oil Volumes

2012

Model		Damper Technology (Drive Side)	Volume (ml) Upper Tube	Oil wt Upper Tube	Volume (ml) Lower Leg	Oil wt Lower Leg	Spring Technology (Non-Drive Side)	Volume (ml) Upper Tube	Oil wt Upper Tube	Volume (ml) Lower Leg	Oil wt Lower Leg
Argyle	RCT	Motion Control	143	5	3-8	15	Solo Air	-		3-8	15
	RC		130		10		Coil			30	
	R	Rebound					Coil				
BoXXer	World Cup	Motion Control DH	230	5	10	15	Solo Air with Volume Adjust	-		10	15
	R2C2						Coil with Drop Stop			40	
	RC	Motion Control IS	290				Coil				
Domain	Dual Crown RC	Motion Control IS	325	5	10	15	Coil	-		40	15
	Dual Crown R	Rebound	370								
	RC	Motion Control	200				Coil U-Turn			30	
							Coil				
	R	Rebound					Coil U-Turn				
							Coil				
Lyrik	RC2L/RC2DH	Mission Control/ Mission Control DH	184	5	10	15	2-Step	-		10	15
							Solo Air				
							U-Turn				
	RC	Motion Control IS	187				2-Step				
							Solo Air				
							U-Turn				
	R	Rebound	213				Solo Air				
							Coil				
Reba	RLT, RL	Motion Control	106	5	5	15	Dual Air	Grease		5	15
	RL3		111								
Recon Gold	RL	Motion Control	133	5	6	15	Solo Air	3	15	6	15
							Coil	-		10	
	TK, TK 29	Turnkey					Solo Air	3	15	6	
							Coil	-		10	
	R	Rebound					Solo Air	3	15	6	
							Coil	-		10	

SUSPENSION FORK
Oil Volumes

2012

Model		Damper Technology (Drive Side)	Volume (ml) Upper Tube	Oil wt Upper Tube	Volume (ml) Lower Leg	Oil wt Lower Leg	Spring Technology (Non-Drive Side)	Volume (ml) Upper Tube	Oil wt Upper Tube	Volume (ml) Lower Leg	Oil wt Lower Leg
Recon Silver	RL	Motion Control	147	5	6	15	Solo Air	3	15	6	15
							Coil	-		10	
	TK	Turnkey					Solo Air	3	15	6	
							Coil	-		10	
	R	Rebound					Solo Air	3	15	6	
							Coil	-		10	
	TK 29	Turnkey	133				Solo Air	3	15	6	
							Coil	-		10	
Revelation	XX World Cup, XX, World Cup, RCT3, RLT, RL	Motion Control	134	5	5	15	Dual Position Air	Grease		5	15
							Dual Air				
SID (100)	XX, World Cup	Motion Control	98	5	5	15	Dual Air	Grease		5	15
SID (120)	XX World Cup, XX, World Cup, RCT3, RLT	Motion Control	106	5	5	15	Dual Air	Grease		5	15
	WC3, RLT3, RL3		111								
Sektor	RL	Motion Control	130	5	3-8	15	Solo Air	-		5-8	15
			120		10-16		U-Turn 130				
			125				U-Turn 140				
							U-Turn 150				
	TK	Turnkey	130		3-8		Dual Position Coil				
	R	Rebound	120		10-16		Dual Position Coil				
			125								
Tora	TK	Turnkey	145	5	5	15	Solo Air	3	15	10	15
	302	Turnkey	150	5	15	15	Solo Air			15	
							Coil U-Turn	-		30	
							Coil			20	
	289	Rebound					Coil U-Turn			30	
							Coil			20	

SUSPENSION FORK
Oil Volumes

2012

Model		Damper Technology (Drive Side)	Volume (ml) Upper Tube	Oil wt Upper Tube	Volume (ml) Lower Leg	Oil wt Lower Leg	Spring Technology (Non-Drive Side)	Volume (ml) Upper Tube	Oil wt Upper Tube	Volume (ml) Lower Leg	Oil wt Lower Leg
Totem	RC2L/RC2DH	Mission Control/ Mission Control DH	203	5	15	15	2-Step	-	-	10	15
							Solo Air			15	
							Coil				
	RC	Motion Control IS	193				Coil				
XC 32	TK	Turnkey	145	5	5	15	Coil	-	-	10	15
XC 30	TK	Turnkey	100	5	10	15	Coil	-	-	10	15
XC 28 (80/100)	TK	Turnkey	93	5	-	-	Coil	-	-	-	-
	R	Rebound									
XC 28 (120)	TK	Turnkey	109	5	10	15	Coil	-	-	-	-
	R	Rebound									
XC 28 (29)	TK	Turnkey	93	5	10	15	Coil	-	-	-	-

2013
Monarch RT3
Service Manual

GEN.0000000004179 Rev A

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SRAM LLC WARRANTY

Extent of Limited Warranty

Except as otherwise set forth herein, SRAM warrants its products to be free from defects in materials or workmanship for a period of two years after original purchase. This warranty only applies to the original owner and is not transferable. Claims under this warranty must be made through the retailer where the bicycle or the SRAM component was purchased. Original proof of purchase is required. **Except as described herein, SRAM makes no other warranties, guaranties, or representations of any type (express or implied), and all warranties (including any implied warranties of reasonable care, merchantibility, or fitness for a particular purpose) are hereby disclaimed.**

Local law

This warranty statement gives the customer specific legal rights. The customer may also have other rights which vary from state to state (USA), from province to province (Canada), and from country to country elsewhere in the world.

To the extent that this warranty statement is inconsistent with the local law, this warranty shall be deemed modified to be consistent with such law, under such local law, certain disclaimers and limitations of this warranty statement may apply to the customer. For example, some states in the United States of America, as well as some governments outside of the United States (including provinces in Canada) may:

a. Preclude the disclaimers and limitations of this warranty statement from limiting the statutory rights of the consumer (e.g. United Kingdom).
b. Otherwise restrict the ability of a manufacturer to enforce such disclaimers or limitations.

Limitations of Liability

To the extent allowed by local law, except for the obligations specifically set forth in this warranty statement, in no event shall SRAM or its third party suppliers be liable for direct, indirect, special, incidental, or consequential damages.

Limitations of Warranty

This warranty does not apply to products that have been incorrectly installed and/or adjusted according to the respective SRAM technical installation manual. The SRAM installation manuals can be found online at sram.com, rockshox.com, avidbike.com, truvativ.com, zipp.com, or quarq.com.

This warranty does not apply to damage to the product caused by a crash, impact, abuse of the product, non-compliance with manufacturers specifications of usage or any other circumstances in which the product has been subjected to forces or loads beyond its design.

This warranty does not apply when the product has been modified, including, but not limited to any attempt to open or repair any electronic and electronic related components, including the motor, controller, battery packs, wiring harnesses, switches, and chargers.
This warranty does not apply when the serial number or production code has been deliberately altered, defaced or removed.
This warranty does not apply to normal wear and tear. Wear and tear parts are subject to damage as a result of normal use, failure to service according to SRAM recommendations and/or riding or installation in conditions or applications other than recommended.

Wear and tear parts are identified as:

- Dust seals
- Bushings
- Air sealing o-rings
- Glide rings
- Rubber moving parts
- Foam rings
- Rear shock mounting hardware and main seals
- Upper tubes (stanchions)
- Stripped threads/bolts (aluminium, titanium, magnesium or steel)
- Brake sleeves
- Brake pads
- Chains
- Sprockets
- Cassettes
- Shifter and brake cables (inner and outer)
- Handlebar grips
- Shifter grips
- Jockey wheels
- Disc brake rotors
- Wheel braking surfaces
- Bottomout pads
- Bearings
- Bearing races
- Pawls
- Transmission gears
- Spokes
- Free hubs
- Aero bar pads
- Corrosion
- Tools
- Motors
- Batteries

Notwithstanding anything else set forth herein, this warranty is limited to one year for all electronic and electronic related components including motors, controllers, battery packs, wiring harnesses, switches, and chargers. The battery pack and charger warranty does not include damage from power surges, use of improper charger, improper maintenance, or such other misuse.

This warranty shall not cover damages caused by the use of parts of different manufacturers.

This warranty shall not cover damages caused by the use of parts that are not compatible, suitable and/or authorised by SRAM for use with SRAM components.

This warranty shall not cover damages resulting from commercial (rental) use.

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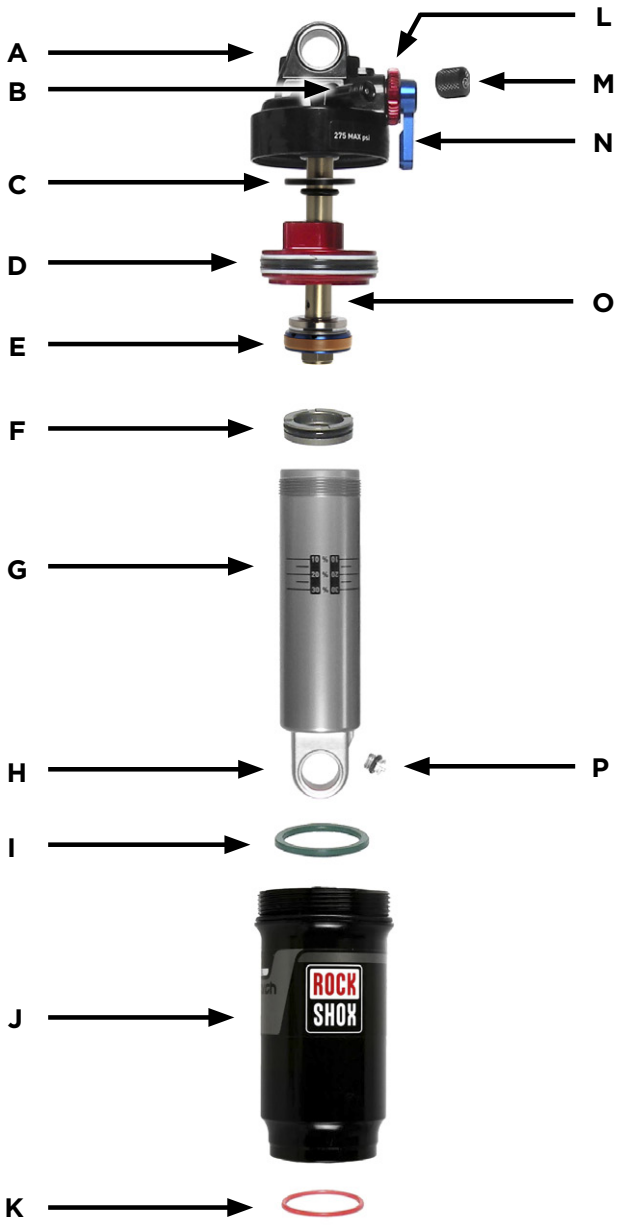
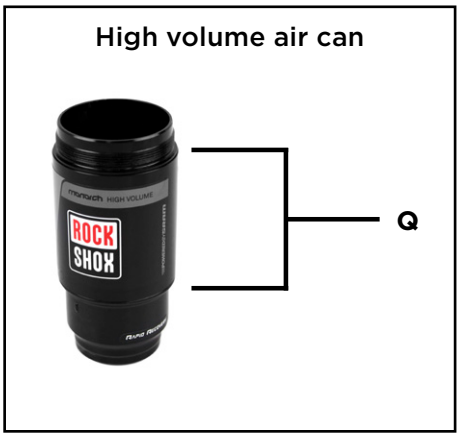
SAFETY FIRST!

We care about YOU. Please, always wear your safety glasses and protective gloves when servicing RockShox products.
Protect yourself! Wear your safety gear!

EXPLODED VIEW - MONARCH RT3 REAR SHOCK ASSEMBLY





A. Shaft eyelet
B. Air can valve
C. Bottom out washer
D. Seal head/air piston
E. Main piston
F. IFP (Internal Floating Piston)
G. Damper body
H. Damper body eyelet
I. Top out bumper
J. Air can
K. Sag indicator o-ring
L. Rebound adjuster
M. Air can valve cap
N. Compression lever
O. Shaft
P. Damper air fill port cap
Q. High volume air can sleeve

ROCKSHOX SUSPENSION SERVICE

We recommend that you have your RockShox suspension serviced by a qualified bicycle mechanic. Servicing RockShox suspension requires knowledge of suspension components as well as the special tools and fluids used for service.

For exploded diagram and part number information, please refer to the Spare Parts Catalog available on our web site at www.sram.com.

For order information, please contact your local SRAM distributor or dealer.

Information contained in this publication is subject to change at any time without prior notice. For the latest technical information, please visit our website at sram.com.

Your product's appearance may differ from the pictures/diagrams contained in this publication.

MOUNTING HARDWARE AND BUSHING SERVICE

Prior to servicing the rear shock, remove it from the bicycle frame according to the bicycle manufacturer's instructions. Once the shock is removed from the bicycle, remove the mounting hardware before performing any service.

NOTICE

Use aluminum soft jaws to prevent damage to the rear shock eyelets when clamping into a vise.

PARTS AND TOOLS FOR MOUNTING AND BUSHING SERVICE

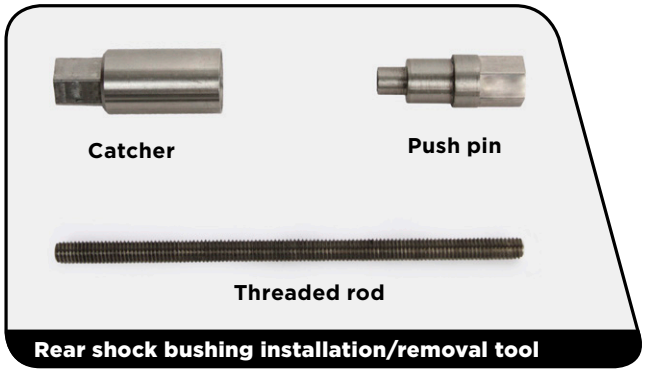
- Safety glasses
- Nitrile gloves
- Apron
- Clean, lint-free rags
- Suspension specific grease
- Bench vise with aluminum soft jaws
- SRAM rear shock bushing removal/installation tool
- 13 mm open end wrench
- Adjustable wrench

MOUNTING HARDWARE REMOVAL

Some mounting hardware is easily removed using only your fingers. Try to remove the end spacers with your fingernail, then push the bushing pin out of the bushing. If this works, move on to the next section, Eyelet Bushing Replacement.

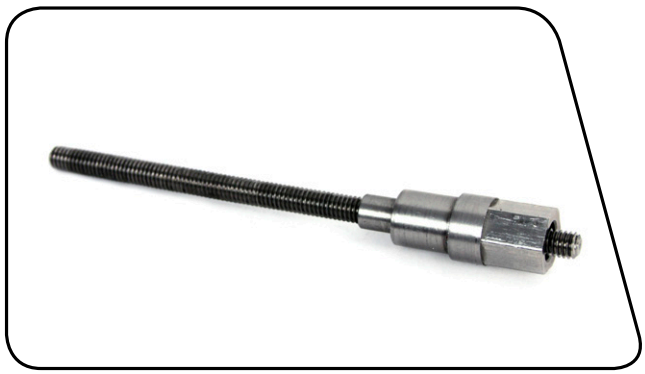
If you are unable to remove the mounting hardware using your fingers, use the SRAM rear shock bushing removal/installation tool.

Images in the following steps are of Monarch RL, but are applicable to Monarch RT3.



Rear shock bushing installation/removal tool

1 Thread the small end of the push pin onto the threaded rod until the rod is flush or slightly protrudes from the hex-shaped end of the push pin.



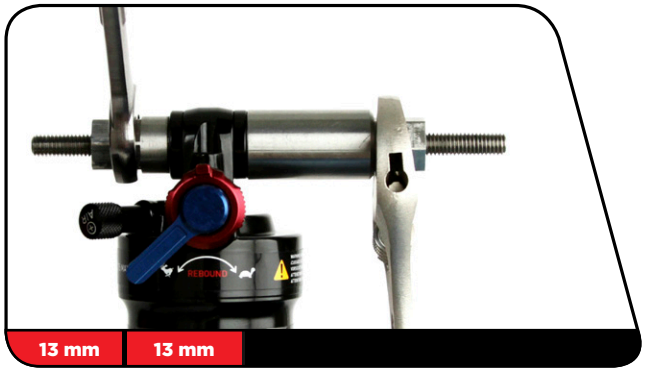
2 Insert the threaded rod through the shaft eyelet until the push pin rests against the bushing pin.

Thread the large, open end of the catcher along the rod until it rests on the end spacer.

3 Clamp the catcher in a vise or hold it secure with a 13 mm open end or adjustable wrench.

Use a second 13 mm wrench to thread the push pin along the rod until it stops against the end spacer.

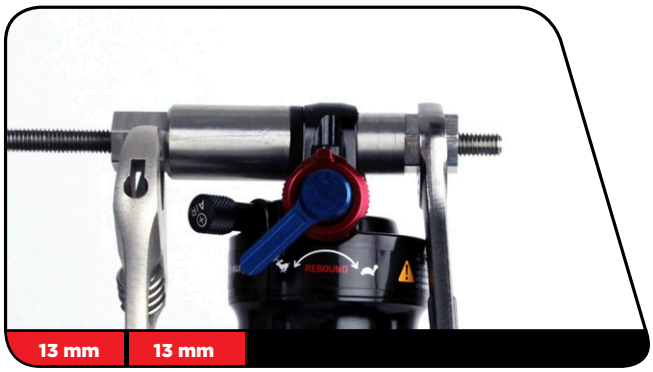
Unthread the push pin from the threaded rod and remove the end spacer from that side.



4 Reinsert the threaded rod and push pin through the shaft eyelet.

Thread the large, open end of the catcher along the rod until it rests against the shaft eyelet.

Use a 13 mm wrench to thread the push pin along the rod until it stops against the end spacer.



5 Unthread the catcher from the threaded rod.

Remove the end spacer and bushing pin from the tool.

Set the mounting hardware aside until you have finished servicing your shock.

Repeat for the damper eyelet.

EYELET BUSHING REPLACEMENT

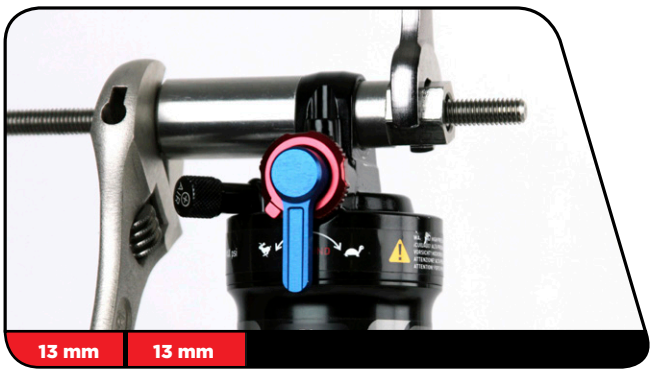
To replace damaged or worn out bushings, use the RockShox rear shock bushing removal/installation tool.

1 Insert the threaded rod through the shaft eyelet until the base of the push pin rests against the bushing.

Thread the large, open end of the catcher onto the rod until it rests on the eyelet.

2 Clamp the catcher in a vise or hold it secure with a 13 mm wrench.

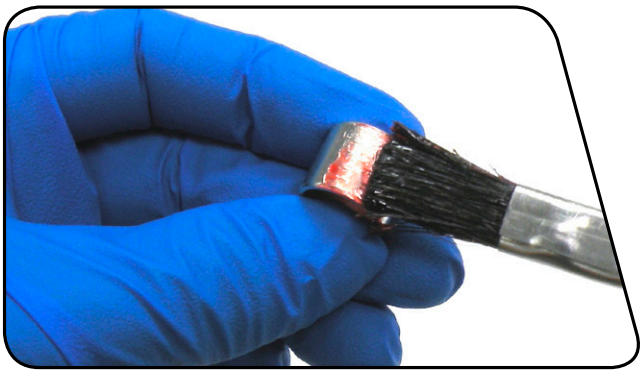
Use a second 13 mm wrench to thread the push pin along the rod until the push pin pushes the eyelet bushing out of the eyelet.



3 Unthread the catcher from the threaded rod. Remove the tool from the shaft eyelet and discard the old bushing.

Repeat for the other eyelet.

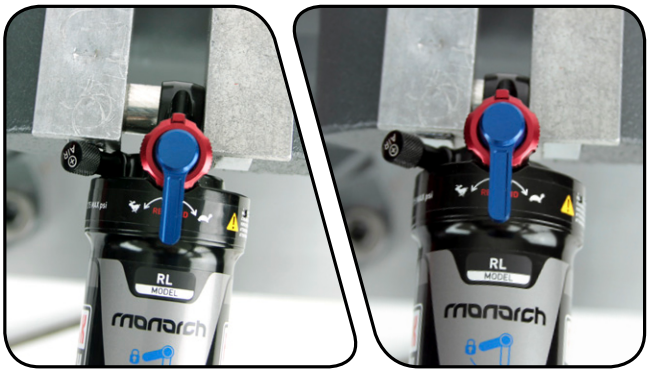
4 Apply a small amount of grease to the outside of the new bushing.



5 Position the shaft eyelet and eyelet bushing between the soft jaws of a vise. Slowly turn the vise handle to begin pressing the eyelet bushing into the shaft eyelet.

To prevent damage to the shock use aluminum vise soft jaws and position the eyelet in the vise so that the adjustment knobs are clear of the vise jaws.

Check the alignment of the bushing as it enters the eyelet. If the bushing starts to enter the eyelet at an angle, remove the bushing from the eyelet, regrease the bushing, and repeat this step until the bushing enters the eyelet straight.



6 Continue to press the eyelet bushing until it is seated in the shaft eyelet.

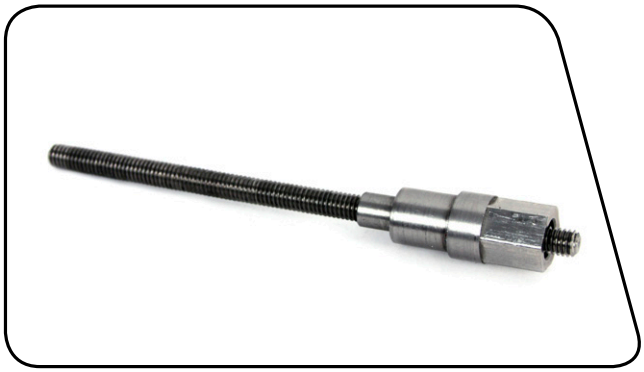
Remove the shock from the vise and repeat the installation process for the other bushing and eyelet.

MOUNTING HARDWARE INSTALLATION

Some mounting hardware is easily installed using only your fingers. Press the bushing pin into the shock eyelet bushing until the pin protrudes from both sides of the eyelet an equal amount. Next, press an end spacer, large diameter side first, onto each end of the bushing pin. If this works, you have completed mounting hardware and bushing service.

If you are unable to install your mounting hardware using your fingers, use the SRAM rear shock bushing removal/installation tool.

1 Thread the small end of the push pin onto the threaded rod until the push pin is flush or slightly protrudes from the hex-shaped end of the push pin.



2 Insert the threaded rod through the bushing pin then through the shaft eyelet so that the bushing pin is positioned between the push pin and the eyelet.

3 Thread the large, open end of the catcher onto the rod until it rests on the eyelet.

4 Clamp the catcher in a vise or hold it secure with a 13 mm wrench.

Use a second 13 mm wrench to thread the push pin along the rod until it pushes the bushing pin into the shock eyelet bushing.

Continue to thread the push pin until the bushing pin protrudes from both sides of the eyelet an equal amount.

You may need to unthread the catcher slightly to check the bushing pin spacing.

5 Unthread the catcher from the threaded rod and remove the tool from the shaft eyelet.

6 Position the end spacer with the large end facing the air can. Use your fingers to push the end spacer onto each end of the bushing pin.

MONARCH RT3 SERVICE

Prior to servicing your rear shock, remove it from the bicycle frame according to the bicycle manufacturer's instructions. Once the shock is removed from the bicycle, remove the mounting hardware before performing any service (see the Mounting Hardware And Bushing Service section).

PARTS AND TOOLS NEEDED FOR SERVICE

- Safety glasses
- Nitrile gloves
- Apron
- Clean, lint-free rags
- Oil pan
- Isopropyl alcohol
- RockShox 7wt suspension fluid
- Suspension specific grease
- Parker® O-Lube
- Maxima® Maxum4 Extra 15w50 lube
- Bench vise with aluminum soft jaws
- SRAM vise block
- Blue threadlock
- SRAM shaft clamp
- 12, 13, and 17 mm open end wrench
- Torque wrench
- 13 and 17 mm crowfoot
- 12 mm socket
- 1.5 and 2 mm hex wrenches
- Schrader valve core tool
- Strap wrench
- Needle nose pliers
- Pick
- Monarch air fill adapter
- Shock pump
- Metric caliper or small metric ruler

SAFETY INSTRUCTIONS

Always wear safety glasses and nitrile gloves when working with suspension fluid.

Place an oil pan on the floor underneath the area where you will be working on the shock.

AIR CAN REMOVAL

1 Turn the rebound adjuster counter-clockwise (toward the rabbit) until it stops. Turn the compression lever to the unlocked position.

Count each detent click as you turn the adjuster and record the number of clicks to assist with post-service set up.

2 Check and record your current air pressure setting to assist with post-service set up.

Remove the air valve cap.

Use a small hex to depress the Schrader valve and release all air pressure from the air can.

Use a Schrader valve tool to remove the valve core from the valve body.

3 Use a Schrader valve tool to remove the air/nitrogen port cap.

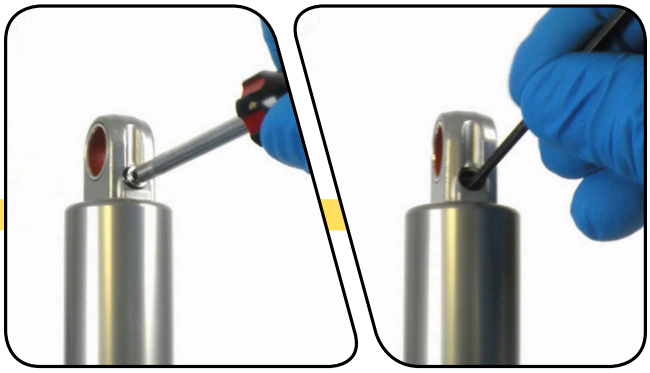
Use a small hex wrench or pick to depress the Schrader valve and release all air/nitrogen pressure from the damper.

Once the pressure has been released, depress the Schrader valve a second time. If the Schrader valve is able to move, the shock has been completely depressurized.

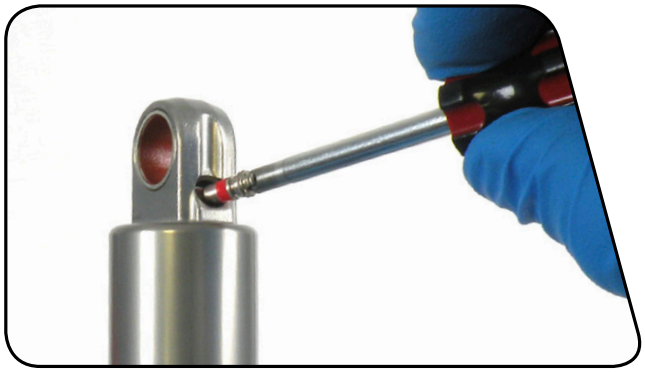
⚠ CAUTION - EYE HAZARD

Verify all pressure is removed from the shock before proceeding. Failure to do so can cause the damper body to separate from the shaft eyelet at a high velocity. Wear safety glasses.

If the Schrader valve does not move at all, the shock is still pressurized and will need to be sent to an authorized RockShox service center for further service.



4 Use a Schrader valve tool to remove the valve core.



5 Clamp the shaft eyelet into a bench vise, with the shock positioned horizontally.

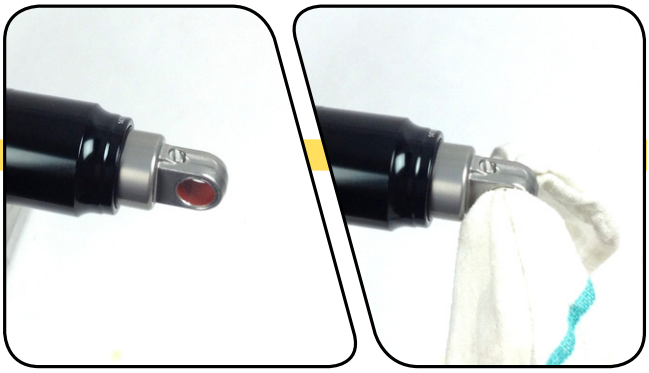
To prevent damage to the shock use aluminum vise soft jaws and position the eyelet in the vise so that the adjustment knobs are clear of the vise jaws.

6 If the shock is collapsed so that a minimal amount of damper body is visible, there is still air pressure in the air can.

Insert a rag through the damper body eyelet. This will prevent the air can from forcefully ejecting from the shock upon disassembly.

⚠ CAUTION- EYE HAZARD

Disassembly of a pressurized air can may cause suspension fluid or debris to forcefully eject from the shock. Wear safety glasses.



7 Use a strap wrench to remove the air can. Wrap the strap around the section of the air can furthest from the shaft eyelet. Turn the wrench counter-clockwise to loosen and unthread the air can.

Once it is completely unthreaded, slowly pull the air can along the shock damper body to remove it.

Do not place the strap wrench on the air can decal.

For high volume air cans: Grip the lower portion of the can; otherwise, the high volume sleeve will rotate independent of the air can preventing the air can from unthreading.

Vacuum pressure will increase as you pull the air can along the damper body, then suddenly release as the end of the can comes over the damper body eyelet.

AIR CAN SERVICE

1 Use a pick to pierce the air can dust wiper seal and quad ring located inside the dust wiper seal gland. Push or pull to remove them, paying attention to the orientation of the dust wiper seal for reinstallation.

Do not scoop or dig the seals out as this may damage the seal gland.

2 Use a pick to remove the two back-up rings out of the air can.

Do not scoop or dig the seals out as this may damage the seal gland.

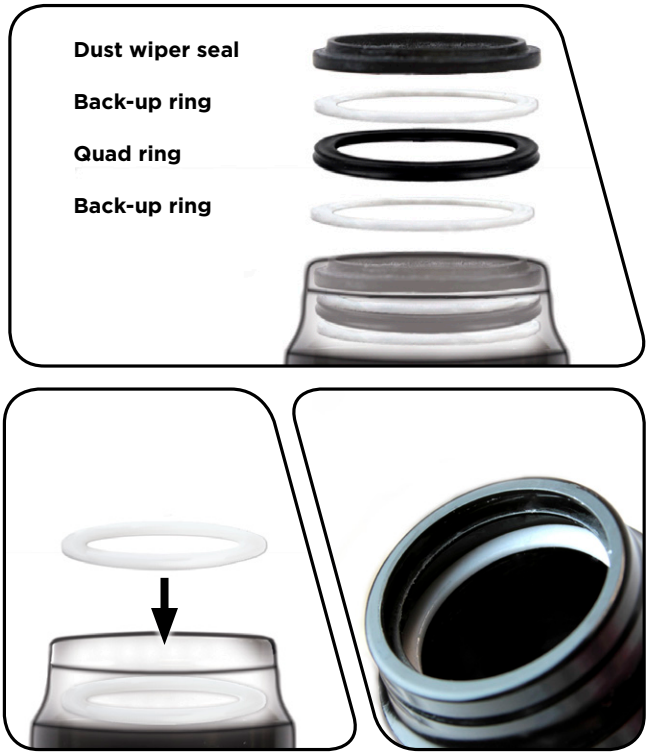
3 Spray isopropyl alcohol inside the air can and wipe it with a clean rag. Remove a glove and use your finger to inspect the inside and outside of the air can for scratches, dents, or other surface deformations. Replace the air can if it is scratched or damaged.

All air cans have a small dimple, as seen from the exterior of the can, that you should feel during inspection. This is normal.

In addition, high volume air cans have small port hole to the high volume sleeve that you should feel. This is normal.

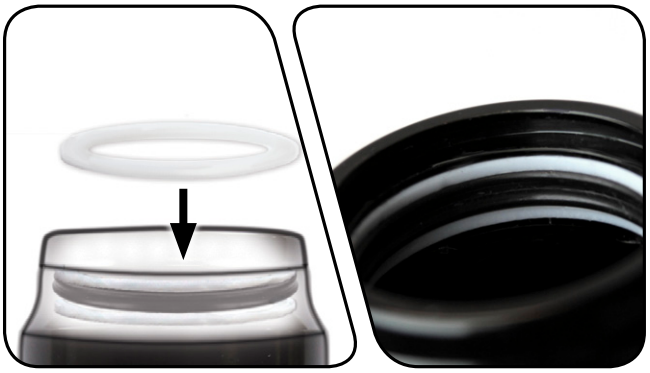
4 Install the new back-up rings, quad ring, back-up ring, and dust wiper seal.

Install a back-up ring by inserting one end into the air can, then push the remainder of the ring into the can, so that it rests on the bottom of the second deepest gland.

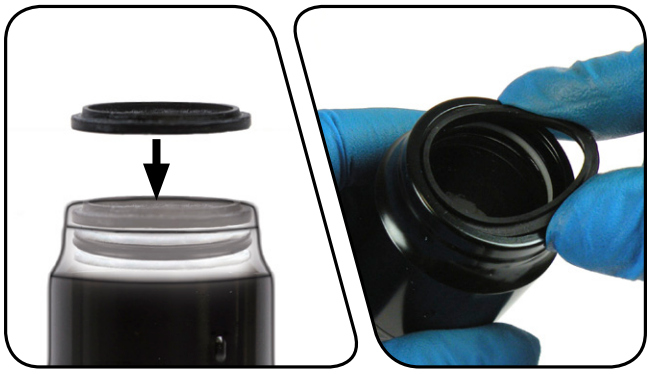


5 Apply a small amount of Parker® O-Lube grease to the new quad ring and install it above the back-up ring in the second deepest gland.

6 Install the other back-up ring by inserting one end into the air can, then push the remainder of the ring into the can, so that it rests on the quad ring at the top of the second deepest gland.



7 Orient the new dust wiper seal step side up. Install it into the dust wiper seal gland at the top of the air can.



8 Spray isopropyl alcohol on the air can threads and eyelet body threads and wipe them with a clean rag.

9 Apply a small amount of Parker® O-Lube grease to the quad ring, back-up rings, and dust wiper seal.

Set the air can aside.

10 **For High Volume Air Cans Only:**

Remove the retention o-ring from the high volume sleeve.

Firmly grip the high volume sleeve and slide it off of the air can.

Use your fingers to remove the high volume sleeve o-rings, clean the seal glands, and apply Parker® O-Lube to the new seals, then reinstall.

Spray isopropyl alcohol inside the high volume sleeve and wipe it with a clean, lint-free rag.

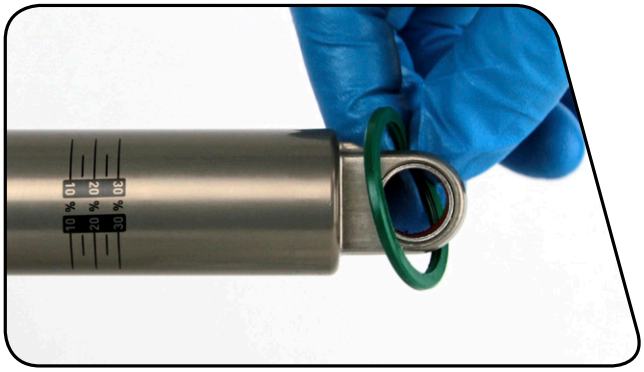
Evenly spread just enough Parker O-Lube to make the inside of the sleeve slippery. This stops the o-rings from rolling as the sleeve slides over them.

Slide the air sleeve onto the air can.

Reinstall the high volume sleeve retention o-ring into the groove outside of the air can.

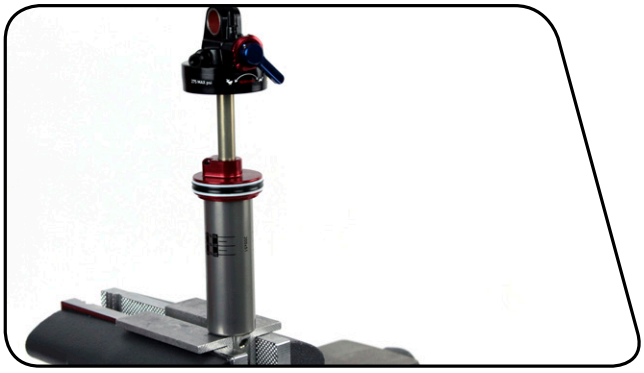
DAMPER BODY SERVICE

1 Remove the top out bumper on the damper body. Replace with a new one.

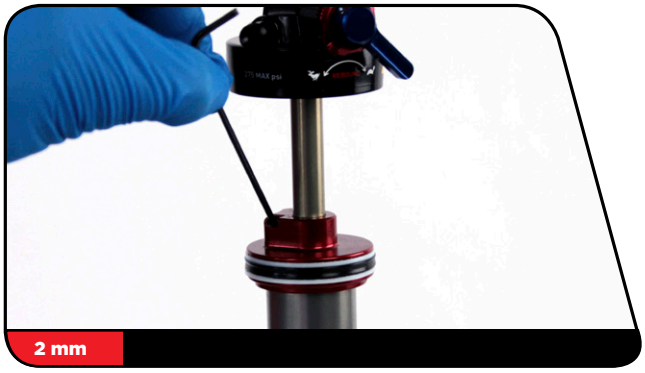


2 Remove the shock from the vise. Turn the shock over and clamp the damper eyelet into the vise, so the shock is vertical.

Use aluminum vise soft jaws to protect the shock eyelet when clamped.

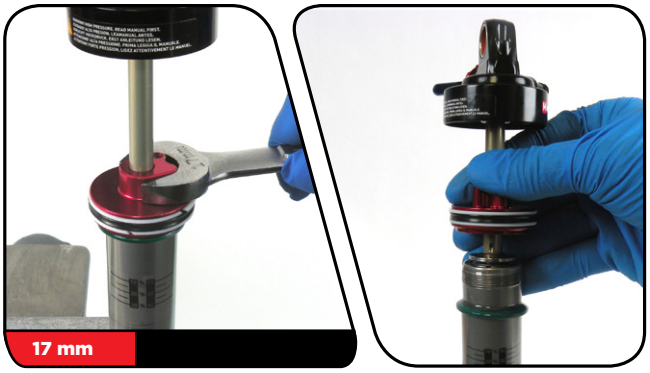


3 Use a 2 mm hex to unthread and remove the bleed screw, located in the seal head/air piston.

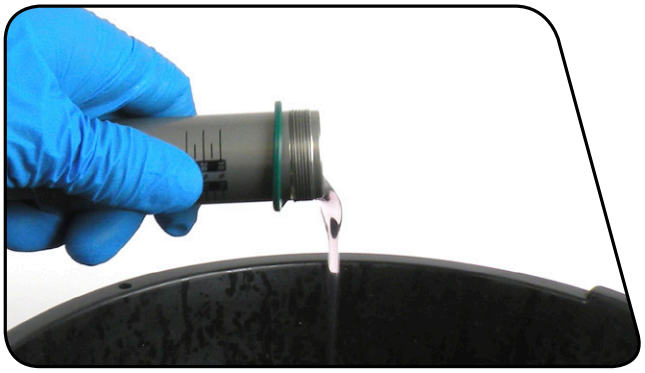


4 Use a 17 mm open end wrench to loosen and remove the seal head/air piston assembly from the damper body.

Fluid will spill from the assembly.



5 Remove the damper body from the vise and pour the fluid into an oil pan.



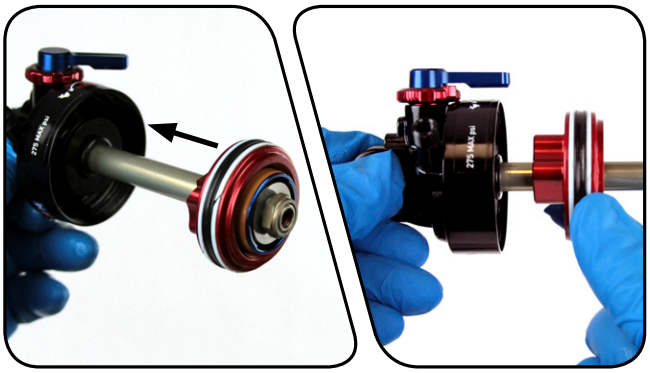
PISTON SERVICE

For a complete list of available Monarch piston tunes, refer to the most current RockShox spare parts catalog in the service page of www.sram.com.

1 Spray isopropyl alcohol on the shaft assembly and shaft clamp, wipe it with a clean rag.

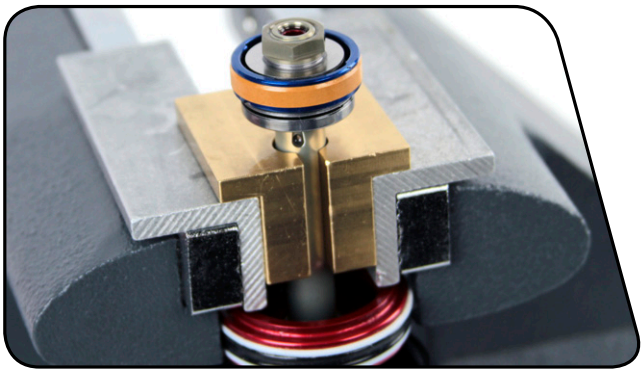
2 Hold the shaft eyelet with one hand, and push the seal head/air piston toward the shaft eyelet with your other hand

Be careful not to pinch your fingers as you slide the seal head/ air piston.



3 Use the SRAM shaft clamp tool to clamp the seal head/air piston into a vise with the main piston positioned vertically.

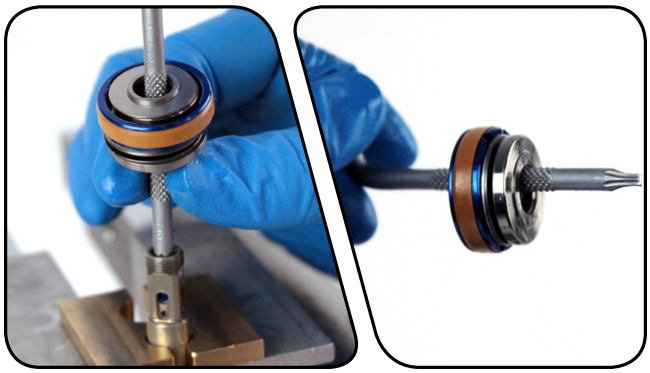
Do not remove the shaft from the eyelet.



4 Use a 12 mm wrench to unthread the piston nut.

5 Remove the main piston assembly by using a small torx® wrench or pick to slide the main assembly off the shaft.

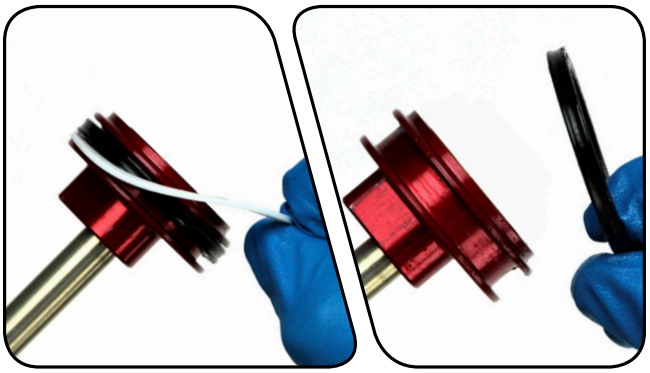
Keep all the parts together and set aside.

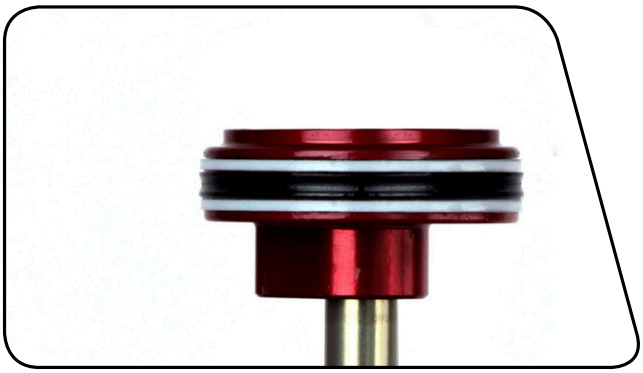


6 Use a pick to remove the seal head/air piston seal and glide rings.

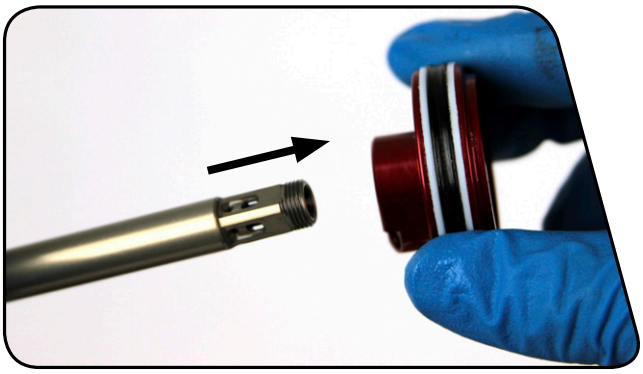
Apply a small amount of Parker® O-Lube to the new seal head/air piston seal and glide rings, and install them.

Do not scoop or dig the seals out as this may damage the seal gland.





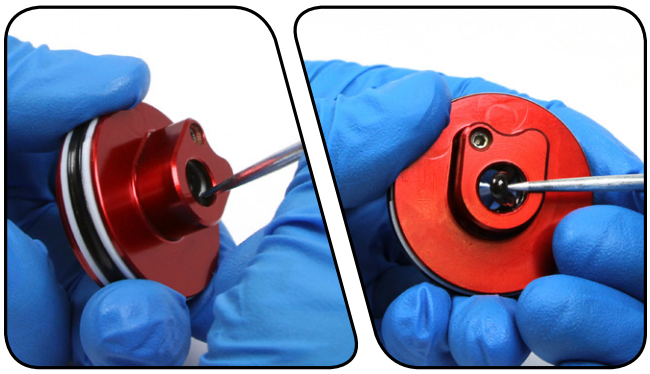
7 Pull on the seal head/air piston to remove it from the damper shaft.



8 Use a pick to remove the o-ring located in the interior of the seal head.

Apply a small amount of Parker® O-Lube to the new o-ring and install it.

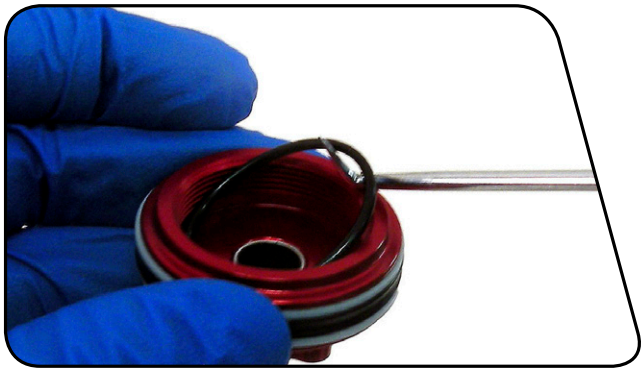
Do not scratch the seal head/air piston. Scratches may cause fluid to leak.



9 Use a pick to remove the inner o-ring, located at the base of the threads in the seal head/air piston.

Apply Parker® O-Lube to the o-ring and install it.

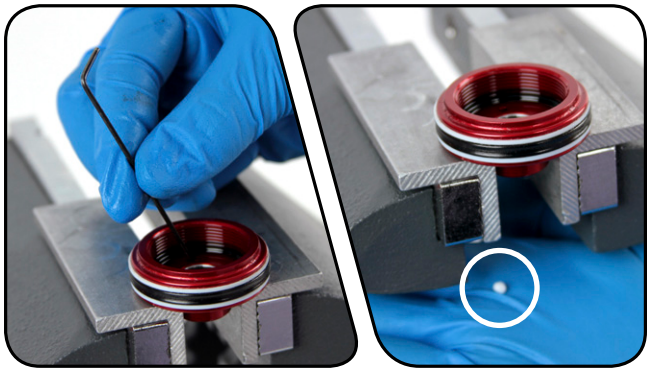
Do not scratch the seal head/air piston. Scratches may cause fluid to leak.



10 Use a pick or 1.5 mm hex wrench to push and remove the compression ball out of the backside of the seal head through the bleed port.

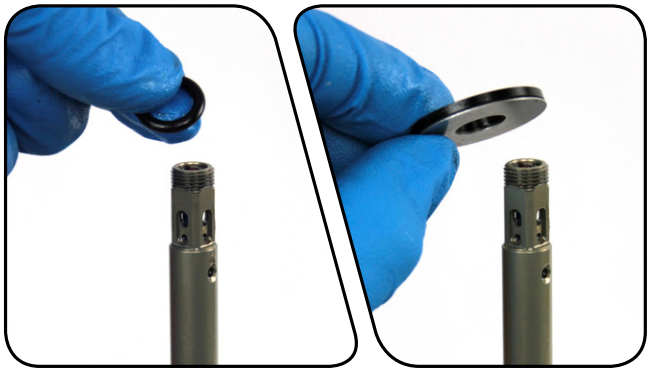
Do not replace the compression ball at this time, you will do that later.

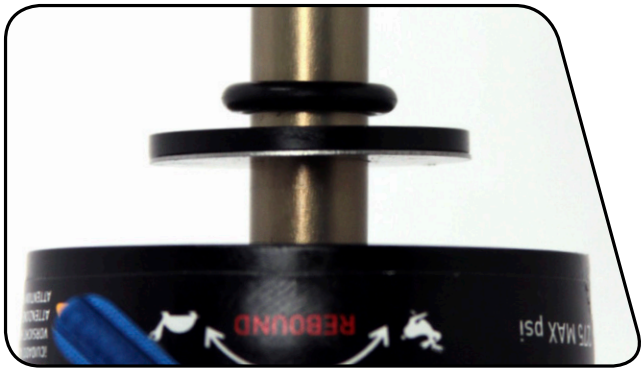
Do not reuse the compression ball.



11 Remove the bottom out washer and o-ring from the shaft.

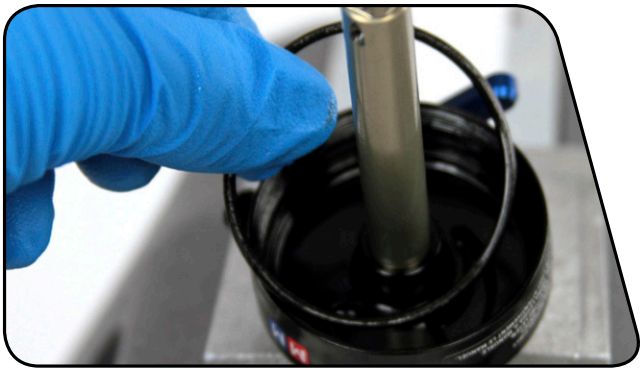
Replace the bottom out washer so the metal side is oriented toward the shaft eyelet. Slide the new o-ring on the shaft so that it rests on top of the plastic side of the bottom out washer.



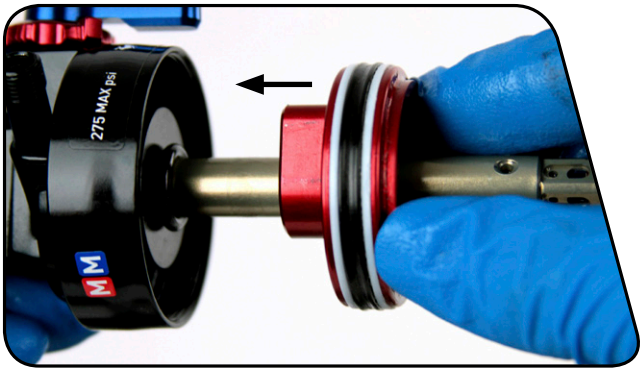


12 Use a pick to remove the o-ring located in the interior of the shaft eyelet threads.

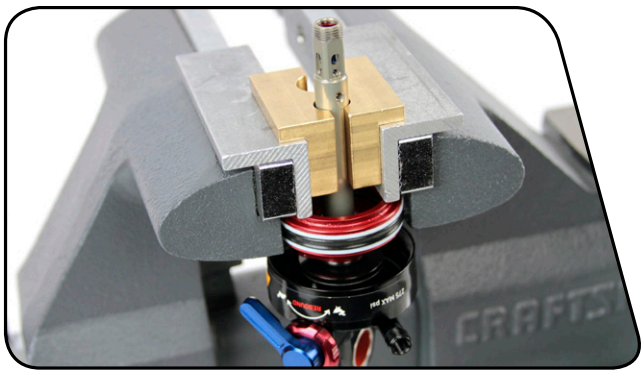
Apply a small amount of Parker® O-Lube on the new o-ring and install it.



13 Reinstall the seal head/air piston onto the damper shaft with the seal head threads oriented upward.



14 Use the SRAM shaft clamp tool to clamp the seal head/air piston into a vise with the eyelet positioned vertically.



15 Use a small Torx® wrench or pick to reinstall the shim stack on one side of the main piston. Use your fingers to squeeze the shims and center the shim stack.

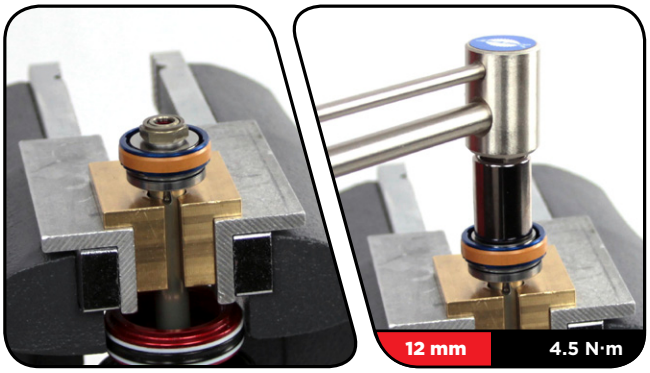
Slide the main piston and the remaining shims onto the shaft. Use a small pick to center the shim stack along the inside edge of the main piston.

If shims are not centered, the shock will not perform properly.

If desired, install a new piston tune. Refer to the most current RockShox spare parts catalog on the service page of www.sram.com.

16 Thread the main piston, by hand, onto the damper shaft.

Use a torque wrench with a 12 mm socket to tighten it to 4.5 N·m (40 in-lb).

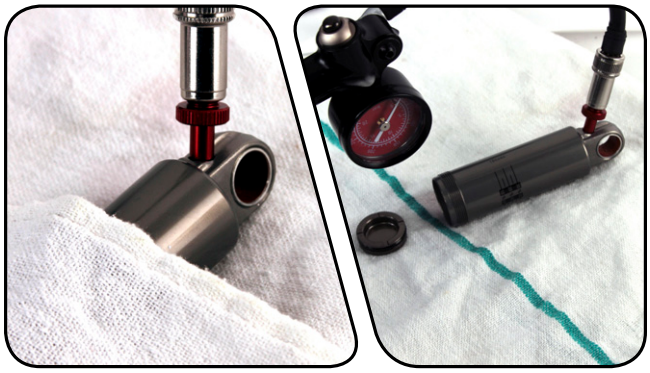


17 Remove the shaft assembly from the vise and set it aside.

IFP AND DAMPER BODY SERVICE

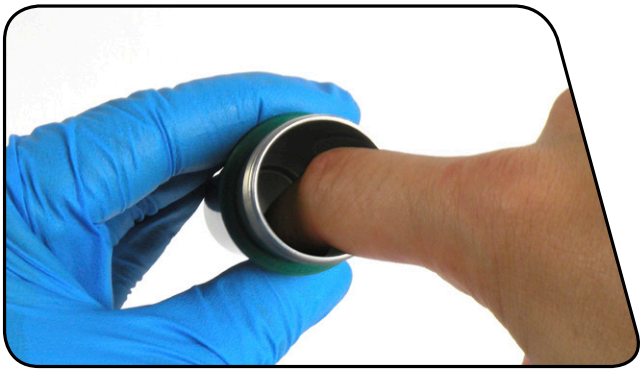
1 Wrap a rag around the end of the damper body. Thread a shock pump with the Monarch air fill adapter installed onto it into the air fill port.

Pump air into the damper body to force the IFP (Internal Floating Piston) out of the damper body, into the rag.



2 Spray isopropyl alcohol on the inside and outside of the damper body and wipe it with a clean rag.

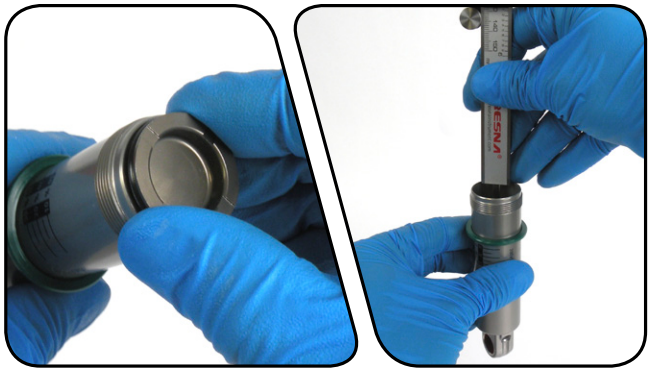
Remove a glove and use your finger to inspect the inside and outside of the damper body for scratches, dents, or other surface deformations. If any deformations are found, the damper body will need to be replaced.



3 Remove the IFP o-ring. Spray the IFP with isopropyl alcohol and wipe it with a clean rag.

Apply a small amount of grease to the new o-ring and install it.

4 Insert the IFP into the damper body with the stepped side visible. Use a metric caliper or ruler to push the IFP to the depth specified in the table below

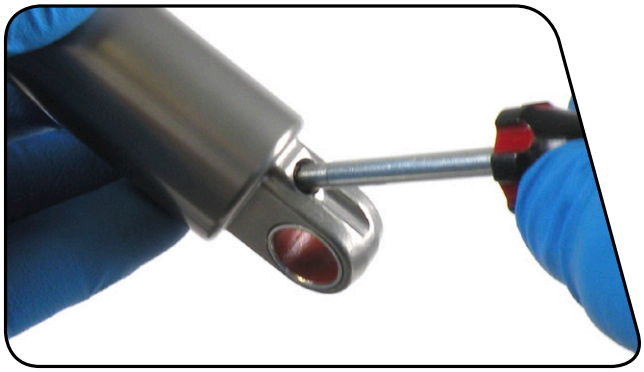


Measure the IFP depth from the lowest part of the IFP.

Shock dimensions	IFP insertion depth
152x31	44.1 mm
165x38	49.4 mm
184x44	54.8 mm
190x51	60.2 mm
200x51	60.2 mm
200x57	65.6 mm
216x63	70.9 mm
222x66	73.1 mm

SHOCK ASSEMBLY AND BLEED

1 Use a Schrader valve core tool to install the new Schrader valve into the damper body air fill port.



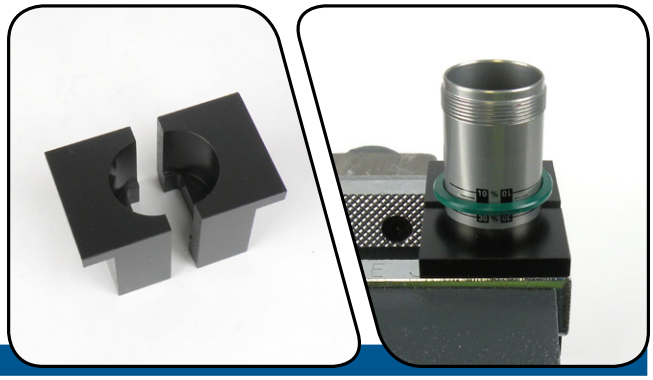
2 Place the damper body into the SRAM vise block, clamp into the vise so the damper body is positioned vertically.

Tighten the vise firmly enough so that the IFP cannot move in the damper body. Check this by using your finger to push on the IFP.

If it does not move, the vise is tight enough. If it does move, remove the damper body from the vise, reset the IFP to the proper depth, then reinstall it into the vise blocks and vise tight enough that the IFP cannot move.

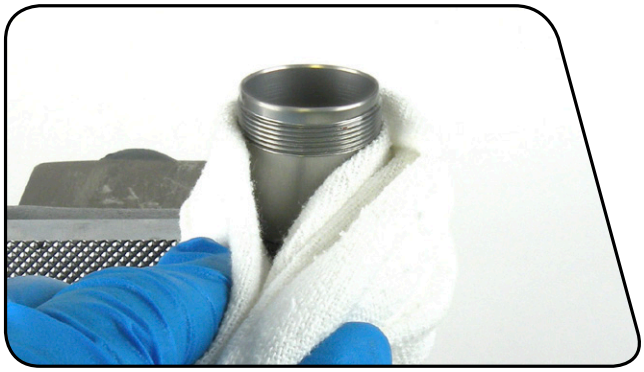
Wrap a clean rag around the damper body.

Do not overtighten the vise so that the damper body gets crushed.

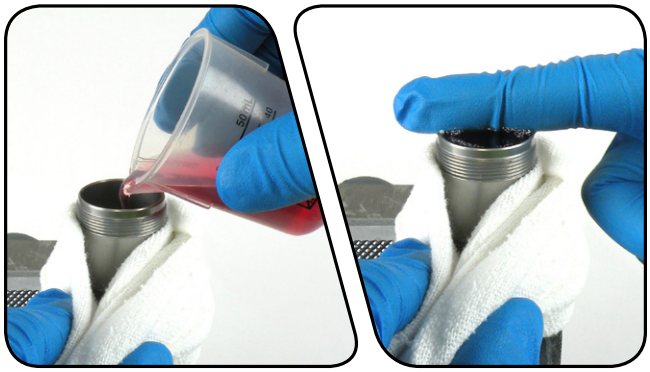


NOTICE

The SRAM vise block holds the IFP in place. Failure to use the SRAM vise block when clamping the damper body into the vise may result in improper IFP height. Improper IFP height can reduce the performance of the shock.

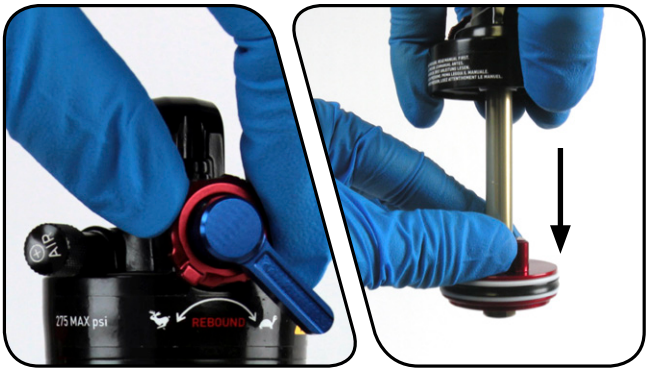


3 Pour new RockShox 7wt suspension fluid into the the damper body until it is level with the top of the damper body. Use your finger to remove any bubbles from the surface of the fluid.



4 Check that the the rebound adjuster is set to the minimum setting (toward the rabbit).

Slide the seal head/air piston until it stops at the end of the damper shaft.

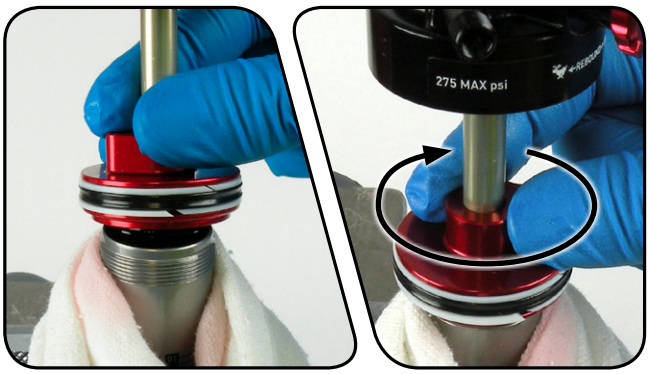


5 Install the seal head/air piston onto the damper body and thread it completely onto the damper body.

Fluid will be displaced out of the bleed port.

Check that the compression ball is removed from the seal head/air piston.

Do not hold on to the shaft eyelet or damper shaft while inserting. It will move the piston/shaft assembly, causing too much fluid to displace out of the damper body.

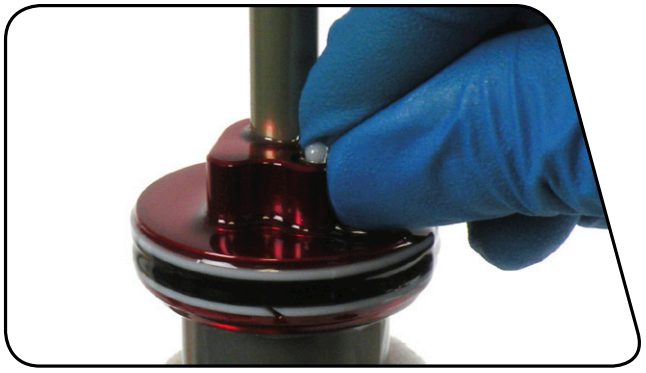


6 Use a torque wrench with 17 mm crow foot to tighten the seal head/air piston to 28 N·m (250 in-lb).

Install the crow foot onto the torque wrench at a 90° angle to the handle to ensure an accurate torque reading.

7 Allow air bubbles to escape from the bleed port in the seal head.

Insert the new compression ball into the bleed port.

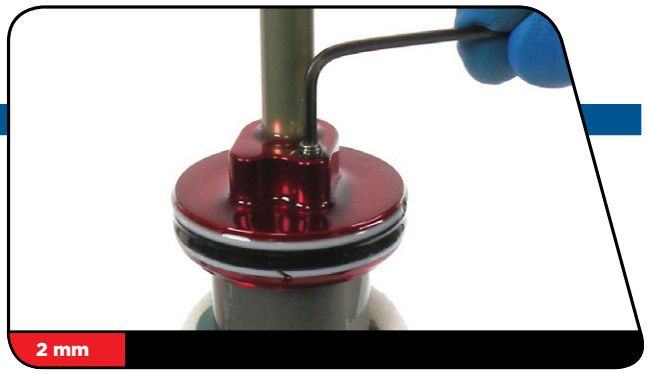


8 Use a 2 mm hex to gently thread the bleed screw into the bleed port until you feel it touch the compression ball.

Tighten the bleed screw an additional ½ turn.

NOTICE

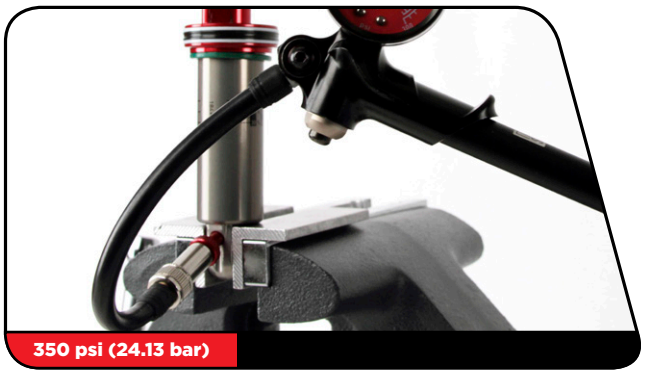
Tightening the bleed screw more than ½ turn can damage the compression ball.



9 Use a shock pump with the Monarch air fill adapter to pressurize the damper body to 350 psi (24.13 bar).

Once you have pressurized the shock, remove the Monarch air fill adapter from the air fill port before removing it from the shock pump. Separating the pump from the adapter first will allow all of the air to escape from the shock.

If you have the proper fill equipment, you may substitute air with nitrogen.



10 Use a Schrader valve tool to install the air fill port cap.

11 Remove the shock from the vise.

Spray the damper assembly with isopropyl alcohol and wipe it with a clean rag.

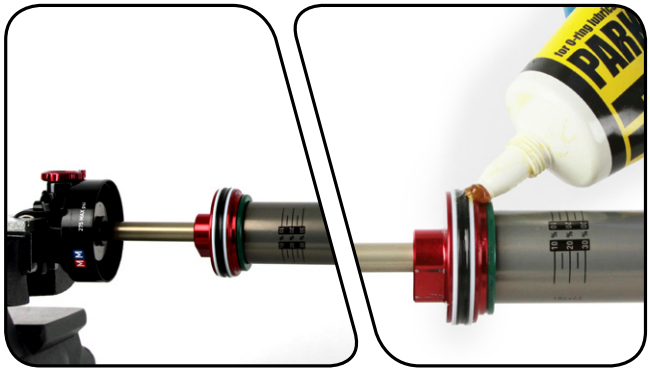
AIR CAN INSTALLATION

1 Clamp the shaft eyelet into a bench vise, so the shock is horizontal.

Apply Parker® O-Lube to the seal head/air piston seals.

Ensure that the top out bumper is installed.

Use aluminum vise soft jaws to protect the damper eyelet when clamped.



2 Apply a small amount of grease to the air can threads. Position the threaded side of the air can over the damper body eyelet.

Firmly press the air can onto the air piston and damper body until the air can is approximately 30 mm from the shaft eyelet threads.

Inject 0.3 mL of Maxima® Maxum4 Extra 15w 50 into the air can.

3 Continue to press the air can onto the damper body until the air can threads and shaft eyelet threads make contact. Thread the air can clockwise into the shaft eyelet. Hand-tighten the air can onto the shaft eyelet.

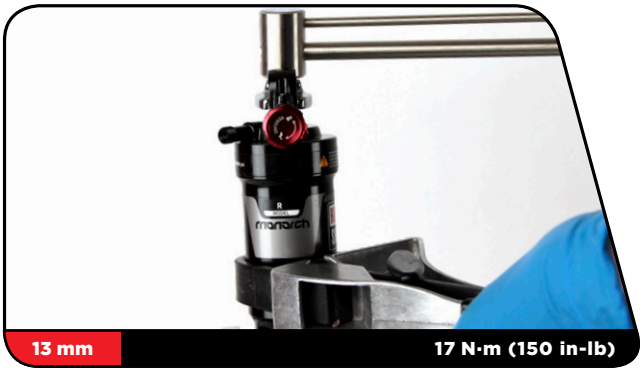
High volume air cans only: Grip the lower portion of the can. Otherwise the high volume sleeve will rotate independent of the air can preventing tightening of the air can.

4 Remove the shock from the vise. Turn it over and clamp the damper eyelet into the vise, so the shock is vertical.

Use isopropyl alcohol and a clean rag to clean the outside of the air can.

Use aluminum vise soft jaws to protect the damper eyelet when clamped.

5 Stabilize the air can with a strap wrench to prevent it from rotating. Use a torque wrench with a 13 mm crowfoot socket to tighten the air can to 4.5 N·m (40 in-lb).



6 Use a Schrader valve tool to install a new Schrader valve into the air can valve.

7 Use a shock pump to inflate the shock to the desired air pressure, then install the valve cap.

8 Remove the shock from the vise. Spray isopropyl alcohol on the entire shock and wipe it with a clean rag.

9 Install the sag indicator o-ring.

10 Reinstall the shock mounting hardware (see the Mounting Hardware And Bushing Service section).

This concludes the service for the Monarch RT3 rear shock. Reinstall the shock to the bicycle frame according to the bicycle manufacturer's instructions.

www.sram.com

ROCK SHOX®

Suspension Fork

user manual

POWERED BY SRAM

IMPORTANT SAFETY INFORMATION

1. It is extremely important that your RockShox suspension fork (fork) is installed correctly by a qualified bicycle mechanic. **Improperly installed forks are extremely dangerous and can result in severe and/or fatal injuries.**
2. The fork on your bicycle is designed for use by a single rider, on mountain trails, and similar off-road conditions.
3. Before riding your bicycle, be sure the brakes are properly installed and adjusted. Use your brakes carefully and learn your brakes' characteristics by practicing your braking technique in non-emergency circumstances. Hard braking or improper use of the front brake can cause you to fall. If the brakes are out of adjustment, improperly installed or are not used properly, the rider could suffer serious and/or fatal injuries.
4. Your fork may fail in certain circumstances, including, but not limited to, any condition that causes a loss of oil; collision or other activity bending or breaking the fork's components or parts; and extended periods of non-use. Fork failure may not be visible. Do not ride your bicycle if you notice bent or broken fork parts, loss of oil, sounds of excessive topping out, or other indications of a possible fork failure, such as loss of shock absorbing properties. Instead, take your bike to a qualified dealer for inspection and repair. In the event of a fork failure, damage to the bicycle or personal injury may result.
5. Always use genuine RockShox parts. Use of aftermarket replacement parts voids the warranty and could cause structural failure to the fork. Structural failure could result in loss of control of the bicycle with possible serious and/or fatal injuries.
6. Use extreme caution not to tilt the bicycle to either side when mounting the bicycle to a carrier by the fork drop-outs (front wheel removed). The fork legs may suffer structural damage if the bicycle is tilted while the drop-outs are in the carrier. Make sure the fork is securely fastened according to the bike carrier's instructions. Make sure the rear wheel is fastened down when using ANY bike carrier that secures the fork's drop-outs. Not securing the rear can allow the bike's mass to side-load the drop-outs, causing them to break or crack. If the bicycle tilts or falls out of its carrier, do not ride the bicycle until the fork is properly examined for possible damage. Return the fork to your dealer for inspection or call RockShox if there is any question of possible damage. The International Distributor List is available on-line at www.sram.com. A fork leg or drop-out failure could result in loss of control of the bicycle with possible serious and/or fatal injuries.
7. **Forks designed for use with rim type brakes:** mount rim type brakes (cantilever, linear-pull, and rim hydraulic) to the existing brake posts only. Forks with hangerless style braces are only designed for linear-pull or hydraulic rim type brakes. Do not use any cantilever brake other than those intended by the brake manufacturer to work with a hangerless brace. Do not route the front brake cable and/or cable housing through the stem or any other mounts or cable stops. Do not use a front brake cable leverage device mounted to the brace. **Forks designed for use with disc-style brakes:** follow the brake manufacturer's installation instructions for proper installation and mounting of the brake caliper. For forks using a post style disc brake mount, ensure that your brake caliper mounting bolts have 9-12 mm of thread engagement and are torqued to 90 in-lb when installed on the fork. Failure to have proper thread engagement can damage the brake mounting posts, which can result in severe injury and/or death.
8. Your RockShox fork is designed to secure a front wheel using a quick release axle or thru axle. Be sure you understand which axle your bike has and how to properly operate it. Do not use a bolt on axle. An improperly installed wheel can allow the wheel to move or disengage from the bicycle, causing damage to the bicycle and serious injury and/or death to the rider.
9. Observe all owner's manual instructions for care and service of this product.

ROCKSHOX FORKS DO NOT COME WITH THE REFLECTORS REQUIRED BY FEDERAL LAW FOR NEW BICYCLES, 16 CFR §1512.16. ADDITIONAL REQUIREMENTS FOR REFLECTORS AND LIGHTING MAY EXIST AND VARY BY LOCATION. YOUR DEALER SHOULD INSTALL PROPER REFLECTORS AND LIGHTING SYSTEMS TO MEET ALL APPLICABLE FEDERAL, STATE, AND LOCAL REQUIREMENTS. ALWAYS USE FRONT AND REAR LIGHTS IN ADDITION TO REFLECTORS IF RIDING AT NIGHT OR IN REDUCED VISIBILITY.

THANKS FOR CHOOSING ROCKSHOX®!

We are excited, pleased, and honored that you have chosen RockShox for your bicycle suspension. You can feel confident that your suspension is the best in the market today because RockShox products are developed and engineered by people who love to ride and who are as passionate about performance as you.

This manual contains the important safety, maintenance, and warranty information you need in order to safely install and use your RockShox suspension. To ensure that your RockShox suspension performs properly, we recommend that you have it installed by a qualified bicycle mechanic.

Additional detailed set-up, tuning, and service information for your RockShox suspension is available online at www.sram.com or www.rockshox.com.

SUSPENSION FORK INSTALLATION

It is extremely important that your RockShox suspension fork (fork) is installed correctly by a qualified bicycle mechanic. **Improperly installed forks are extremely dangerous and can result in severe and/or fatal injuries.**

1. Remove the existing fork from the bicycle. Measure the RockShox steerer tube against the length of the existing one as you may need to cut the RockShox steerer tube. If your RockShox fork has a tapered steerer tube, be sure to leave enough steerer above the taper in order to clamp the stem. Prior to cutting, consult your stem manufacturer's instructions to determine the length of steerer tube required to clamp the stem.
   Aluminum or steel crown-steerer: mark the steerer tube and cut to the proper length.
   Dual crown-steerer: mark the steerer tube and cut to the proper length. If using a direct mount stem make sure 5 mm of steerer tube is exposed above the upper crown and cut to the proper length.
   Carbon crown-steerer: the steerer tube must be cut flush with the top of the stem. Apply masking tape at the cut location to help prevent the carbon from fraying. Use a 28-tooth blade (minimum) and cut to the proper length. Smooth the entire cut area with 400 grit sand paper.
2. Remove the crown race from the existing fork and install it firmly against the RockShox crown Use a 39.8 mm crown race for 1 1/2" steerer tubes and a 29.9 mm crown race for 1 1/8" steerer tubes.
   Do not damage the surface of the carbon crown-steerer when removing and installing the crown race.
3. **Aluminum or steel crown-steerer:** install a star nut or headset compression device into the steerer tube.
   Carbon crown-steerer: install an expansion style plug into the steerer tube. Do not apply more than 11.3 N·m (100 in-lb) of torque to the expansion plug bolt. Do not use star nuts. Torque values may vary depending on headset design and condition.

⚠ WARNING

Do not add threads to RockShox steerers. The steerer tube crown assembly is a one-time press fit. Replacement of the assembly must be done to change the length or diameter of the steerer tube.

Do not remove or replace the steerer tube. This could result in the loss of control of the bicycle with possible serious and/or fatal injuries.

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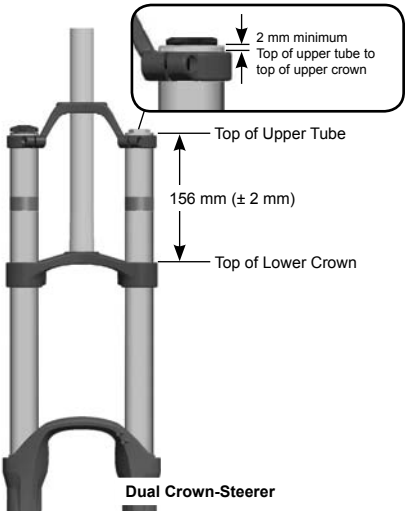
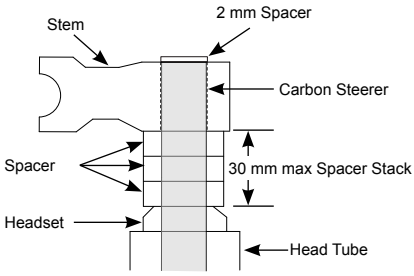
4. Install the fork onto the bike.
   Aluminum or steel crown-steerer: install your stem according to the manufacturer's instructions and adjust the headset until you feel no play or drag.
   Dual crown-steerer: use a short upper crown for head tube and headset stack heights less than 148 mm or a tall upper crown for head tube and headset stack heights up to 168 mm. Adjust the upper crown height to accomodate steerer tube measurements and tighten upper crown bolts to 5 N·m (44 in-lb). Install your stem according to the manufacturer's instructions and adjust the headset until you feel no play or drag. If using a direct mount stem, make sure 5 mm of steerer tube is exposed above the upper crown.



Dual Crown-Steerer

   Carbon crown-steerer: remove any burrs from the stem clamp edges then install your stem according to the manufacturer's instructions. Install a 2 mm spacer above the stem to allow for proper headset adjustment. Do not exceed 30 mm stack height when installing spacers. Adjust the headset until you feel no play or drag.

   Do not exceed the stem manufacturer's torque specifications as it may damage the carbon crown-steerer and reduce the strength of the fork. Cotter style stems are not recommended as the small clamp area may cause damage, especially when over torqued.



Carbon crown-steerer

5. Install your brakes according to the manufacturer's instructions and adjust the brake pads properly. Use only disc style brakes on the provided disc mounting holes. Use only cantilever brakes intended by the brake manufacturer to work with a hangerless brace
6. **Forks designed for standard quick releases:** remove the front wheel by opening the quick release and adjusting the quick release nut to clear the fork dropout's counter bore. Secure the front wheel by tightening the quick release nut after the wheel is properly seated into the fork dropout's counter bore, then close the quick release. Make sure at least four threads engage the quick release nut when it is closed. Orient the quick release lever in front of and parallel to the fork's lower tube in the closed position. **Forks designed for a thru-axle (not available for all forks):** adhere to the installation instructions that follow for the Maxle™ quick release thru axle system.

7. Check tire clearance whenever you change tires. To do this, compress the fork completely and ensure there is at least 6 mm of clearance between the top of the inflated tire and the bottom of the crown.
   To compress the fork completely you may need to remove the air pressure or coil spring from the fork. For complete instructions, refer to the RockShox Technical Manual available on-line at www.sram.com or www. rockshox.com.

⚠ WARNING

Failure to leave 6 mm clearance between the top of the inflated tire and the bottom of the crown will cause the tire to jam against the crown when the fork is fully compressed which can result in severe and/or fatal injuries.

8. Do not let brake or derailleur cables rest on, or be attached to the crown. Abrasion over time may cause damage to the crown. If contact is unavoidable, use tape or similar protection to cover the surface.
   Crown abrasion is not covered under warranty.
9. Take your bicycle to a qualified dealer for inspection and repair if there is any question of component integrity due to a crash or other direct impact.

MAXLE™ QUICK RELEASE THRU AXLE SYSTEM

IMPORTANT SAFETY INFORMATION

The Maxle quick release thru axle system allows the use of a 20 mm x 110 mm or 15 mm x 100 mm thru-axle hub for enhanced stiffness. The axle threads into the non-drive side fork dropout and compresses the hub between the non-drive and drive side fork legs. The axle is fixed in place in the lower leg by the Maxle quick release lever.

Riding with an improperly installed wheel can allow the wheel to move or disengage from the bicycle, causing damage to the bicycle, and serious injury or death to the rider. It is essential that you:

- Ensure that your axle, dropouts, and quick release mechanisms are clean and free of dirt or debris.
- Ask your dealer to help you understand how to properly secure your front wheel using the Maxle quick release thru axle system.
- Apply the correct techniques when installing your front wheel.
- Never ride your bicycle unless you are sure the front wheel is installed properly and secure.

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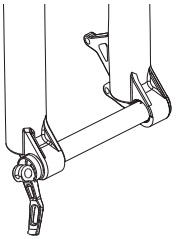
INSTALLATION

Position your wheel in the lower leg dropouts. The hub should seat firmly in the dropouts. Be sure to position the disc brake rotor in the caliper. Verify that neither the rotor, hub, nor rotor bolts interfere with the lower legs. If you are unfamiliar with adjusting your disc brakes, see your brake manufacturer's instructions.

TIGHTEN - Maxle Lite



1. Place the Maxle lever in the open position. Ensure the lever engages with the corresponding slot in the axle.
2. Slide the axle through the right side of the hub until it engages the threads of the left drop out.
3. To tighten the axle into the dropout, position the quick release lever in the slot on the axle flange and turn the axle lever clockwise until hand tight.

   Never use any other tool to tighten the axle into the lower leg. Over-tightening of the axle can damage the axle and/or the lower leg.

TIGHTEN - Maxle DH

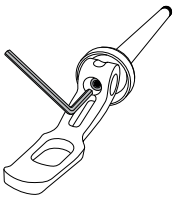
1. Slide the externally threaded end of the Maxle DH through the drive side of the hub, until it engages the threads of the lower leg dropout.
2. Use a 6 mm hex wrench to turn the **drive side** axle bolt and tighten the axle into the dropout. Torque to 5.7 N·m (50 in-lb).

SECURE - Maxle Lite

1. Lift the lever out of the corresponding slot in the axle and rotate to a point 180 degrees from where you want the lever to be located in the closed position.
2. To lock the axle into the lower leg, close the Maxle quick release lever.
3. The quick release mechanism is an "over-center cam", similar to the quick release found on many bicycle wheels.

   When closing the lever, tension should be felt when the quick release lever is in the horizontal position (90 degrees to the lower leg), and the quick release lever should leave a clear imprint in the palm of your hand. If resistance is not felt at the 90 degree position and if the lever does not leave a clear imprint in the palm of your hand, tension is insufficient.

   To increase tension, open the quick release lever and insert a 2.5 mm hex into the tension adjuster located in the center of the lever cam. Turn the adjuster clockwise one click and re-check lever tension. Repeat until the quick release lever tension is sufficient.



⚠ WARNING

Dirt and debris can accumulate between the dropout openings. Always check and clean this area when re-installing the wheel. Accumulated dirt and debris can compromise the security of the axle, leading to serious and/or fatal injury.

SECURE - Maxle DH

Use a 6 mm hex wrench to turn the non-drive side axle bolt clockwise until 8 clicks are heard or felt or a torque value of 3.4 N·m (30 in-lb) is achieved.

⚠ WARNING

After closing the Maxle quick release lever, do not reposition or spin the lever. Repositioning or spinning the Maxle lever can cause the axle to come loose, compromising the security of the axle which can lead to serious injury and/or death.

REMOVAL - Maxle Lite

1. Open the Maxle quick release lever and position it in the slot on the axle flange.
2. Turn the quick release lever counter-clockwise until the axle is disengaged from the threads on the fork dropout then slide the axle out of the hub.

REMOVAL - Maxle DH

1. Use a 6 mm hex wrench to turn the **non-drive side** axle bolt counter-clockwise until no clicks are heard or felt.
2. Use a 6 mm hex wrench to turn the **drive side** axle bolt counter-clockwise until the axle is free from the fork leg, then remove the Maxle DH.

MAINTENANCE

To maintain the high performance, safety, and long life of your front suspension, it is required that you periodically check the fastener torque values for compliance as well as perform routine maintenance on your fork. If you ride in extreme conditions, torque compliance checks and maintenance should be performed more frequently.

⚠ WARNING

Before disassembly or service of any air system remove the air pressure from all air chambers and remove the air valve core from the bottom of the fork. For complete service instructions, visit www.rockshox.com or www.sram.com.

We recommend any service be performed by a qualified bicycle mechanic. To obtain service information or instructions, visit our website at www.sram.com ,www.rockshox.com, or contact your local RockShox dealer or distributor.

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FRONT SUSPENSION FASTENER	TORQUE VALUE
Top Caps (Except Air U-Turn)	7.3 N·m (65 in-lb)
Top Caps (Air U-Turn Only)	14.7 N·m (130 in-lb)
Bottom Bolt	6.8 N·m (60 in-lb)
Bottom Nut	5.1 N·m (45 in-lb)
PopLoc/PushLoc Remote Handlebar Clamp Bolt	2.3 N·m (20 in-lb)
PopLoc/PushLoc Remote Cable Fixing Bolt	0.9 N·m (8 in-lb)
U-Turn Knob Fixing Bolt	1.4 N·m (12 in-lb)
Direct Mount Stem Bolts	8.5 N·m (75 in-lb)
Maxle DH Wedge Expander & Axle Bolt	4.5-6.8 N·m (40-60 in-lb)
Disc Brake Mounting Bolts	10.2 N·m (90 in-lb)
Linear Pull Brake Mounting Bolts	5-7 N·m (44-62 in-lb)
Crown Bolts	5 N·m (44 in-lb)

MAINTENANCE	INTERVAL (hours)
Inspect carbon crown-steerer	Every ride
Clean dirt and debris from upper tubes	Every ride
Check air pressure (air forks only)	Every ride
Inspect upper tubes for scratches	Every ride
Lubricate dust seals and upper tubes	Every ride
Change Speed Lube oil bath	25
Check front suspension fasteners for proper torque	25
Clean and lubricate remote lockout cable and housing	25
Remove lowers, clean/inspect bushings and change oil bath (if applicable)	50
Clean and lubricate air spring assembly	50
Change oil in damping system (including hydraulic lockout)	100
Clean and lubricate coil spring assembly (coil forks only)	100

SRAM LLC WARRANTY

EXTENT OF LIMITED WARRANTY

SRAM warrants its products to be free from defects in materials or workmanship for a period of two years after original purchase. This warranty only applies to the original owner and is not transferable. Claims under this warranty must be made through the retailer where the bicycle or the SRAM component was purchased. Original proof of purchase is required.

LOCAL LAW

This warranty statement gives the customer specific legal rights. The customer may also have other rights which vary from state to state (USA), from province to province (Canada), and from country to country elsewhere in the world.

To the extent that this warranty statement is inconsistent with the local law, this warranty shall be deemed modified to be consistent with such law, under such local law, certain disclaimers and limitations of this warranty statement may apply to the customer. For example, some states in the United States of America, as well as some governments outside of the United States (including provinces in Canada) may:

a. Preclude the disclaimers and limitations of this warranty statement from limiting the statutory rights of the consumer (e.g. United Kingdom).

b. Otherwise restrict the ability of a manufacturer to enforce such disclaimers or limitations.

LIMITATIONS OF LIABILITY

To the extent allowed by local law, except for the obligations specifically set forth in this warranty statement, in no event shall SRAM or its third party supplies be liable for direct, indirect, special, incidental, or consequential damages.

LIMITATIONS OF WARRANTY

This warranty does not apply to products that have been incorrectly installed and/or adjusted according to the respective SRAM technical installation manual. The SRAM installation manuals can be found online at www.sram.com, www.RockShox.com, or www.avidbike.com.

This warranty does not apply to damage to the product caused by a crash, impact, abuse of the product, non-compliance with manufacturers specifications of usage or any other circumstances in which the product has been subjected to forces or loads beyond its design.

This warranty does not apply when the product has been modified.

This warranty does not apply when the serial number or production code has been deliberately altered, defaced or removed.

This warranty does not apply to normal wear and tear. Wear and tear parts are subject to damage as a result of normal use, failure to service according to SRAM recommendations and/or riding or installation in conditions or applications other than recommended.

Wear and tear parts are identified as:

- Dust seals
- Bushings
- Air sealing o-rings
- Glide rings
- Rubber moving parts
- Foam rings
- Rear shock mounting hardware and main seals
- Upper tubes (stanchions)
- Stripped threads/bolts (aluminium, titanium, magnesium or steel)
- Brake sleeves
- Brake pads
- Chains
- Sprockets
- Cassettes
- Shifter and brake cables (inner and outer)
- Handlebar grips
- Shifter grips
- Jockey wheels
- Disc brake rotors
- Wheel braking surfaces
- Bottom out pads
- Bearings
- Bearing races
- Pawls
- Transmission gears
- Tools

This warranty shall not cover damages caused by the use of parts of different manufacturers.

This warranty shall not cover damages caused by the use of parts that are not compatible, suitable and/or authorised by SRAM for use with SRAM components.

This warranty shall not cover damages resulting from commercial (rental) use.

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Ride on open trails only
Leave no trace
Control your bicycle
Always yield trail
Never spook animals
Plan ahead

WORLD HEADQUARTERS
SRAM, LLC
1333 N. Kingsbury, 4th Floor
Chicago Illinois 60642
United States of America

ASIAN HEADQUARTERS
SRAM LLC Taiwan
No. 1598-8 Chung Shan Road
Shen Kang Hsiang, Taichung
County 429 Taiwan R.O.C

EUROPEAN HEADQUARTERS
SRAM LLC Europe
Paasbosweg 14-16
3862ZS Nijkerk
The Nederlands

SPECIALIZED BICYCLE OWNER'S MANUAL

BICYCLE OWNER'S MANUAL

9th Edition, 2007

This manual meets EN Standards 14764, 14765, 14766 and 14781.

This manual meets AS/NZS Standard 1927:1998

IMPORTANT:

This manual contains important safety, performance and service information. Read it before you take the first ride on your new bicycle, and keep it for reference.

Additional safety, performance and service information for specific components such as suspension or pedals on your bicycle, or for accessories such as helmets or lights that you purchase, may also be available. Make sure that your dealer has given you all the manufacturers' literature that was included with your bicycle or accessories. In case of a conflict between the instructions in this manual and information provided by a component manufacturer, always follow the component manufacturer's instructions.

If you have any questions or do not understand something, take responsibility for your safety and consult with your dealer or the bicycle's manufacturer.

NOTE: This manual is not intended as a comprehensive use, service, repair or maintenance manual. Please see your dealer for all service, repairs or maintenance. Your dealer may also be able to refer you to classes, clinics or books on bicycle use, service, repair or maintenance.

Please note all instructions are subject to change for improvement without notice.
Please visit www.specialized.com for periodic tech updates.
Feedback: techdocs@specialized.com

SPECIALIZED BICYCLE COMPONENTS
15130 Concord Circle, Morgan Hill, CA 95037 (408) 779-6229
0000023116_OM R1, 04/13

Introduction

Congratulations! You have in your possession one of the finest bicycle products in the world. The following pages will provide you with the information you need to properly use, adjust, maintain and service your new bike, so you can get the most out of every ride.

It is essential that you read this owner's manual thoroughly before riding your bicycle–we know you're anxious, but trust us, it will only take a few minutes, and then you can unleash the full potential of your Specialized bicycle.

Please pay special attention to the safety information and cautions located throughout this owner's manual, as they are in place to help you avoid serious injury.

If you encounter any issues with your bicycle that aren't covered in this manual, please contact your nearest Authorized Specialized Dealer. As your number one resource, your Specialized dealer can answer questions, perform required maintenance, recommend the best equipment and gear to complement your ride and provide a completely customized bike fit (BG FIT-certified dealers only).

A list of Authorized Specialized Dealers is available online at www.specialized.com.

Thank you for buying a Specialized! We're proud to be your brand of choice.

Now go ride!

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General warning:

Like any sport, bicycling involves risk of injury and damage. By choosing to ride a bicycle, you assume the responsibility for that risk, so you need to know – and to practice – the rules of safe and responsible riding and of proper use and maintenance. Proper use and maintenance of your bicycle reduces risk of injury.

This Manual contains many "Warnings" and "Cautions" concerning the consequences of failure to maintain or inspect your bicycle and of failure to follow safe cycling practices.

- The combination of the ⚠ safety alert symbol and the word **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.
- The combination of the ⚠ safety alert symbol and the word **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or is an alert against unsafe practices.
- The word **CAUTION** used without the safety alert symbol indicates a situation which, if not avoided, could result in serious damage to the bicycle or the voiding of your warranty.

Many of the Warnings and Cautions say "you may lose control and fall". Because any fall can result in serious injury or even death, we do not always repeat the warning of possible injury or death.

Because it is impossible to anticipate every situation or condition which can occur while riding, this Manual makes no representation about the safe use of the bicycle under all conditions. There are risks associated with the use of any bicycle which cannot be predicted or avoided, and which are the sole responsibility of the rider.

A special note for parents:

As a parent or guardian, you are responsible for the activities and safety of your minor child, and that includes making sure that the bicycle is properly fitted to the child; that it is in good repair and safe operating condition; that you and your child have learned and understand the safe operation of the bicycle; and that you and your child have learned, understand and obey not only the applicable local motor vehicle, bicycle and traffic laws, but also the common sense rules of safe and responsible bicycling. As a parent, you should read this manual, as well as review its warnings and the bicycle's functions and operating procedures with your child, before letting your child ride the bicycle.

WARNING: Make sure that your child always wears an approved bicycle helmet when riding; but also make sure that your child understands that a bicycle helmet is for bicycling only, and must be removed when not riding. A helmet must not be worn while playing, in play areas, on playground equipment, while climbing trees, or at any time while not riding a bicycle. Failure to follow this warning could result in serious injury or death.

WARNING: Make sure that your child's bicycle is sized correctly, so that when the saddle is adjusted correctly, both feet can touch the ground. If your child's new bike doesn't fit, ask your dealer to exchange it before you ride it.

1. FIRST

NOTE: We strongly urge you to read this Manual in its entirety before your first ride. At the very least, read and make sure that you understand each point in this section, and refer to the cited sections on any issue which you don't completely understand. Please note that not all bicycles have all of the features described in this Manual. Ask your dealer to point out the features of your bicycle.

A. Bike fit

1. Is your bike the right size? To check, see Section 3.A. If your bicycle is too large or too small for you, you may lose control and fall. If your new bike is not the right size, ask your dealer to exchange it before you ride it.

2. Is the saddle at the right height? To check, see Section 3.B. If you adjust your saddle height, follow the Minimum Insertion instructions in Section 3.B.

3. Are saddle and seat post securely clamped? A correctly tightened saddle will allow no saddle movement in any direction. See Section 3.B.

4. Are the stem and handlebars at the right height for you? If not, see Section 3.C.

5. Can you comfortably operate the brakes? If not, you may be able to adjust their angle and reach. See Section 3.D and 3.E.

6. Do you fully understand how to operate your new bicycle? If not, before your first ride, have your dealer explain any functions or features which you do not understand.

B. Safety first

1. Always wear an approved helmet when riding your bike, and follow the helmet manufacturer's instructions for fit, use and care.

2. Do you have all the other required and recommended safety equipment? See Section 2. It's your responsibility to familiarize yourself with the laws of the areas where you ride, and to comply with all applicable laws.

3. Do you know how to correctly secure your front and rear wheels? Check Section 4.A.1 to make sure. Riding with an improperly secured wheel can cause the wheel to wobble or disengage from the bicycle, and cause serious injury or death.

4. If your bike has toeclips and straps or clipless ("step-in") pedals, make sure you know how they work (see Section 4.E). These pedals require special techniques and skills. Follow the pedal manufacturer's instructions for use, adjustment and care.

5. Do you have "toe overlap"? On smaller framed bicycles your toe or toeclip may be able to contact the front wheel when a pedal is all the way forward and the wheel is turned. Read Section 4.E. to check whether you have toeclip overlap.

6. Does your bike have suspension? If so, check Section 4.F. Suspension can change the way a bicycle performs. Follow the suspension manufacturer's instructions for use, adjustment and care.

C. Mechanical Safety Check

Routinely check the condition of your bicycle before every ride.

■ **Nuts, bolts screws & other fasteners:** Because manufacturers use a wide variety of fastener sizes and shapes made in a variety of materials, often differing by model and component, the correct tightening force or torque cannot be generalized. To make sure that the many fasteners on your bicycle are correctly tightened, refer to the Fastener Torque Specifications in Appendix D of this manual or to the torque specifications in the instructions provided by the manufacturer of the component in question. Correctly tightening a fastener requires a calibrated torque wrench. A professional bicycle mechanic with a torque wrench should torque the fasteners on you bicycle. If you choose to work on your own bicycle, you must use a torque wrench and the correct tightening torque specifications from the bicycle or component manufacturer or from your dealer. If you need to make an adjustment at home or in the field, we urge you to exercise care, and to have the fasteners you worked on checked by your dealer as soon as possible.

WARNING: Correct tightening force on fasteners -nuts, bolts, screws- on your bicycle is important. Too little force, and the fastener may not hold securely. Too much force, and the fastener can strip threads, stretch, deform or break. Either way, incorrect tightening force can result in component failure, which can cause you to loose control and fall.

■ Make sure nothing is loose. Lift the front wheel off the ground by two or three inches, then let it bounce on the ground. Anything sound, feel or look loose? Do a visual and tactile inspection of the whole bike. Any loose parts or accessories? If so, secure them. If you're not sure, ask someone with experience to check.

■ **Tires & Wheels:** Make sure tires are correctly inflated (see Section 4.G.1). Check by putting one hand on the saddle, one on the intersection of the handlebars and stem, then bouncing your weight on the bike while looking at tire deflection. Compare what you see with how it looks when you know the tires are correctly inflated; and adjust if necessary.

■ Tires in good shape? Spin each wheel slowly and look for cuts in the tread and sidewall. Replace damaged tires before riding the bike.

■ Wheels true? Spin each wheel and check for brake clearance and side-to-side wobble. If a wheel wobbles side to side even slightly, or rubs against or hits the brake pads, take the bike to a qualified bike shop to have the wheel trued.

CAUTION: Wheels must be true for rim brakes to work effectively. Wheel trueing is a skill which requires special tools and experience. Do not attempt to true a wheel unless you have the knowledge, experience and tools needed to do the job correctly.

■ Wheel rims clean and undamaged? Make sure the rims are clean and undamaged at the tire bead and, if you have rim brakes, along the braking surface. Check to make sure that any rim wear indicator marking is not visible at any point on the wheel rim.

WARNING: Bicycle wheel rims are subject to wear. Ask your dealer about wheel rim wear. Some wheel rims have a rim wear indicator which becomes visible as the rim's braking surface wears. A visible rim wear indicator on the side of the wheel rim is an indication that the wheel rim has reached its maximum usable life. Riding a wheel that is at the end of its usable life can result in wheel failure, which can cause you to loose control and fall.

- **Brakes:** Check the brakes for proper operation (see Sections 4.C). Squeeze the brake levers. Are the brake quick-releases closed? All control cables seated and securely engaged? If you have rim brakes, do the brake pads contact the wheel rim squarely and make full contact with the rim? Do the brakes begin to engage within an inch of brake lever movement? Can you apply full braking force at the levers without having them touch the handlebar? If not, your brakes need adjustment. Do not ride the bike until the brakes are properly adjusted by a professional bicycle mechanic.

- **Wheel retention system:** Make sure the front and rear wheels are correctly secured. See Section 4.A

- **Seat post:** If your seat post has an over-center cam action fastener for easy height adjustment, check that it is properly adjusted and in the locked position. See Section 4.B.

- **Handlebar and saddle alignment:** Make sure the saddle and handlebar stem are parallel to the bike's center line and clamped tight enough so that you can't twist them out of alignment. See Sections 3.B and 3.C.

- **Handlebar ends:** Make sure the handlebar grips are secure and in good condition. If not, have your dealer replace them. Make sure the handlebar ends and extensions are plugged. If not, have your dealer plug them before you ride. If the handlebars have bar end extensions, make sure they are clamped tight enough so you can't twist them.

WARNING: Loose or damaged handlebar grips, end plugs or extensions should be replaced, as they can expose the ends of the handlebar, which have been known to cause injury, and they can cause you to lose control and fall. Unplugged handlebars or extensions can cut you and cause serious injury in an otherwise minor accident.

This warning is particulary important for children's bikes, which should be inspected regularly to ensure that adequate protection for the ends of the handlebar are in place.

VERY IMPORTANT SAFETY NOTE:

Please also read and become thoroughly familiar with the important information on the lifespan of your bicycle and its components in Appendix B on Page 42.

D. First ride

When you buckle on your helmet and go for your first familiarization ride on your new bicycle, be sure to pick a controlled environment, away from cars, other cyclists, obstacles or other hazards. Ride to become familiar with the controls, features and performance of your new bike.

Familiarize yourself with the braking action of the bike (see Section 4.C). Test the brakes at slow speed, putting your weight toward the rear and gently applying the brakes, rear brake first. Sudden or excessive application of the front brake could pitch you over the handlebars. Applying brakes too hard can lock up a wheel, which could cause you to lose control and fall. Skidding is an example of what can happen when a wheel locks up.

If your bicycle has toeclips or clipless pedals, practice getting in and out of the pedals. See paragraph B.4 above and Section 4.E.4.

If your bike has suspension, familiarize yourself with how the suspension responds to brake application and rider weight shifts. See paragraph B.6 above and Section 4.F.

Practice shifting the gears (see Section 4.D). Remember to never move the shifter while pedaling backward, nor pedal backwards immediately after having moved the shifter. This could jam the chain and cause serious damage to the bicycle.

Check out the handling and response of the bike; and check the comfort.

If you have any questions, or if you feel anything about the bike is not as it should be, consult your dealer before you ride again.

2. SAFETY

A. The Basics

WARNING: The area in which you ride may require specific safety devices. It is your responsibility to familiarize yourself with the laws of the area where you ride and to comply with all applicable laws, including properly equipping yourself and your bike as the law requires.

Observe all local bicycle laws and regulations. Observe regulations about bicycle lighting, licensing of bicycles, riding on sidewalks, laws regulating bike path and trail use, helmet laws, child carrier laws, special bicycle traffic laws. It's your responsibility to know and obey the laws.

1. Always wear a cycling helmet which meets the latest certification standards and is appropriate for the type of riding you do. Always follow the helmet manufacturer's instructions for fit, use and care of your helmet. Most serious bicycle injuries involve head injuries which might have been avoided if the rider had worn an appropriate helmet.

WARNING: Failure to wear a helmet when riding may result in serious injury or death.

2. Always do the Mechanical Safety Check (Section 1.C) before you get on a bike.

3. Be thoroughly familiar with the controls of your bicycle: brakes (Section 4.C.); pedals (Section 4.E.); shifting (Section 4.D.)

4. Be careful to keep body parts and other objects away from the sharp teeth of chainrings, the moving chain, the turning pedals and cranks, and the spinning wheels of your bicycle.

5. Always wear:

- Shoes that will stay on your feet and will grip the pedals. Make sure that shoe laces cannot get into moving parts, and never ride barefoot or in sandals.
- Bright, visible clothing that is not so loose that it can be tangled in the bicycle or snagged by objects at the side of the road or trail.
- Protective eyewear, to protect against airborne dirt, dust and bugs – tinted when the sun is bright, clear when it's not.

6. Don't jump with your bike. Jumping a bike, particularly a BMX or mountain bike, can be fun; but it can put huge and unpredictable stress on the bicycle and its components. Riders who insist on jumping their bikes risk serious damage, to their bicycles as well as to themselves. Before you attempt to jump, do stunt riding or race with your bike, read and understand Section 2.F.

7. Ride at a speed appropriate for conditions. Higher speed means higher risk.

B. Riding Safety

1. Obey all Rules of the Road and all local traffic laws.

2. You are sharing the road or the path with others – motorists, pedestrians and other cyclists. Respect their rights.

3. Ride defensively. Always assume that others do not see you.

4. Look ahead, and be ready to avoid:

- Vehicles slowing or turning, entering the road or your lane ahead of you, or coming up behind you.
- Parked car doors opening.
- Pedestrians stepping out.
- Children or pets playing near the road.
- Pot holes, sewer grating, railroad tracks, expansion joints, road or sidewalk construction, debris and other obstructions that could cause you to swerve into traffic, catch your wheel or cause you to have an accident.
- The many other hazards and distractions which can occur on a bicycle ride.

5. Ride in designated bike lanes, on designated bike paths or as close to the edge of the road as possible, in the direction of traffic flow or as directed by local governing laws.

6. Stop at stop signs and traffic lights; slow down and look both ways at street intersections. Remember that a bicycle always loses in a collision with a motor vehicle, so be prepared to yield even if you have the right of way.

7. Use approved hand signals for turning and stopping.

8. Never ride with headphones. They mask traffic sounds and emergency vehicle sirens, distract you from concentrating on what's going on around you, and their wires can tangle in the moving parts of the bicycle, causing you to lose control.

9. Never carry a passenger, unless it is a small child wearing an approved helmet and secured in a correctly mounted child carrier or a child-carrying trailer.

10. Never carry anything which obstructs your vision or your complete control of the bicycle, or which could become entangled in the moving parts of the bicycle.

11. Never hitch a ride by holding on to another vehicle.

12. Don't do stunts, wheelies or jumps. If you intend to do stunts, wheelies,

jumps or go racing with your bike despite our advice not to, read Section 2.F, *Downhill, Stunt or Competition Biking,* **now**. Think carefully about your skills before deciding to take the large risks that go with this kind of riding.

13. Don't weave through traffic or make any moves that may surprise people with whom you are sharing the road.

14. Observe and yield the right of way.

15. Never ride your bicycle while under the influence of alcohol or drugs.

16. If possible, avoid riding in bad weather, when visibility is obscured, at dawn, dusk or in the dark, or when extremely tired. Each of these conditions increases the risk of accident.

C. Off Road Safety

We recommend that children not ride on rough terrain unless they are accompanied by an adult.

1. The variable conditions and hazards of off-road riding require close attention and specific skills. Start slowly on easier terrain and build up your skills. If your bike has suspension, the increased speed you may develop also increases your risk of losing control and falling. Get to know how to handle your bike safely before trying increased speed or more difficult terrain.

2. Wear safety gear appropriate to the kind of riding you plan to do.

3. Don't ride alone in remote areas. Even when riding with others, make sure that someone knows where you're going and when you expect to be back.

4. Always take along some kind of identification, so that people know who you are in case of an accident; and take along some cash for food, a cool drink or an emergency phone call.

5. Yield right of way to pedestrians and animals. Ride in a way that does not frighten or endanger them, and give them enough room so that their unexpected moves don't endanger you.

6. Be prepared. If something goes wrong while you're riding off-road, help may not be close.

7. Before you attempt to jump, do stunt riding or race with your bike, read and understand Section 2.F.

Off Road respect

Obey the local laws regulating where and how you can ride off-road, and respect private property. You may be sharing the trail with others – hikers, equestrians, other cyclists. Respect their rights. Stay on the designated trail. Don't contribute to erosion by riding in mud or with unnecessary sliding. Don't disturb the ecosystem by cutting your own trail or shortcut through vegetation or streams. It is your responsibility to minimize your impact on the environment. Leave things as you found them; and always take out everything you brought in.

D. Wet Weather Riding

WARNING: Wet weather impairs traction, braking and visibility, both for the bicyclist and for other vehicles sharing the road. The risk of an accident is dramatically increased in wet conditions.

Under wet conditions, the stopping power of your brakes (as well as the brakes of other vehicles sharing the road) is dramatically reduced and your tires

don't grip nearly as well. This makes it harder to control speed and easier to lose control. To make sure that you can slow down and stop safely in wet conditions, ride more slowly and apply your brakes earlier and more gradually than you would under normal, dry conditions. See also Section 4.C.

E. Night Riding

Riding a bicycle at night is *much* more dangerous than riding during the day. A bicyclist is very difficult for motorists and pedestrians to see. Therefore, children should never ride at dawn, at dusk or at night. Adults who chose to accept the greatly increased risk of riding at dawn, at dusk or at night need to take extra care both riding and choosing specialized equipment which helps reduce that risk. Consult your dealer about night riding safety equipment.

WARNING: Reflectors are not a substitute for required lights. Riding at dawn, at dusk, at night or at other times of poor visibility without an adequate bicycle lighting system and without reflectors is dangerous and may result in serious injury or death.

Bicycle reflectors are designed to pick up and reflect car lights and street lights in a way that may help you to be seen and recognized as a moving bicyclist.

CAUTION: Check reflectors and their mounting brackets regularly to make sure that they are clean, straight, unbroken and securely mounted. Have your dealer replace damaged reflectors and straighten or tighten any that are bent or loose.

The mounting brackets of front and rear reflectors are often designed as brake straddle cable safety catches which prevent the straddle cable from catching on the tire tread if the cable jumps out of its yoke or breaks.

WARNING: Do not remove the front or rear reflectors or reflector brackets from your bicycle. They are an integral part of the bicycle's safety system.

Removing the reflectors reduces your visibility to others using the roadway. Being struck by other vehicles may result in serious injury or death.

The reflector brackets may protect you from a brake straddle cable catching on the tire in the event of brake cable failure. If a brake straddle cable catches on the tire, it can cause the wheel to stop suddenly, causing you to loose control and fall.

If you choose to ride under conditions of poor visibility, check and be sure you comply with all local laws about night riding, and take the following strongly recommended additional precautions:

- Purchase and install battery or generator powered head and tail lights which meet all regulatory requirements and provide adequate visibility.
- Wear light colored, reflective clothing and accessories, such as a reflective vest, reflective arm and leg bands, reflective stripes on your helmet, flashing lights attached to your body and/or your bicycle ... any reflective device or light source that moves will help you get the

attention of approaching motorists, pedestrians and other traffic.

- Make sure your clothing or anything you may be carrying on the bicycle does not obstruct a reflector or light.
- Make sure that your bicycle is equipped with correctly positioned and securely mounted reflectors.

While riding at dawn, at dusk or at night:

- Ride slowly.
- Avoid dark areas and areas of heavy or fast-moving traffic.
- Avoid road hazards.
- If possible, ride on familiar routes.

If riding in traffic:

- Be predictable. Ride so that drivers can see you and predict your movements.
- Be alert. Ride defensively and expect the unexpected.
- If you plan to ride in traffic often, ask your dealer about traffic safety classes or a good book on bicycle traffic safety.

F. Extreme, stunt or competition riding

Whether you call it *Aggro, Hucking, Freeride, North Shore, Downhill, Jumping, Stunt Riding, Racing* or something else: if you engage in this sort of extreme, aggressive riding *you will get hurt*, and you voluntarily assume a greatly increased risk of injury or death.

Not all bicycles are designed for these types of riding, and those that are may not be suitable for all types of aggressive riding. Check with your dealer or the bicycle's manufacturer about the suitability of your bicycle before engaging in extreme riding.

When riding fast down hill, you can reach speeds achieved by motorcycles, and therefore face similar hazards and risks. Have your bicycle and equipment carefully inspected by a qualified mechanic and be sure it is in perfect condition. Consult with expert riders, area site personnel and race officials on conditions and equipment advisable at the site where you plan to ride. Wear appropriate safety gear, including an approved full face helmet, full finger gloves, and body armor. Ultimately, it is your responsibility to have proper equipment and to be familiar with course conditions.

WARNING: Although many catalogs, advertisements and articles about bicycling depict riders engaged in extreme riding, this activity is extremely dangerous, increases your risk of injury or death, and increases the severity of any injury. Remember that the action depicted is being performed by professionals with many years of training and experience. Know your limits and always wear a helmet and other appropriate safety gear. Even with state-of-the-art protective safety gear, you could be seriously injured or killed when jumping, stunt riding, riding downhill at speed or in competition.

WARNING: Bicycles and bicycle parts have limitations with regard to strength and integrity, and this type of riding can exceed those limitations.

We recommend against this type of riding because of the increased risks; but if you choose to take the risk, at least:

- Take lessons from a competent instructor first
- Start with easy learning exercises and slowly develop your skills before trying more difficult or dangerous riding
- Use only designated areas for stunts, jumping, racing or fast downhill riding
- Wear a full face helmet, safety pads and other safety gear
- Understand and recognize that the stresses imposed on your bike by this kind of activity may break or damage parts of the bicycle and void the warranty
- Take your bicycle to your dealer if anything breaks or bends. Do not ride your bicycle when any part is damaged.
- If you ride downhill at speed, do stunt riding or ride in competition, know the limits of your skill and experience. Ultimately, avoiding injury is your responsibility.

G. Changing Components or Adding Accessories

There are many components and accessories available to enhance the comfort, performance and appearance of your bicycle. However, if you change components or add accessories, you do so at your own risk. The bicycle's manufacturer may not have tested that component or accessory for compatibility, reliability or safety on your bicycle. Before installing any component or accessory, including a different size tire, make sure that it is compatible with your bicycle by checking with your dealer. Be sure to read, understand and follow the instructions that accompany the products you purchase for your bicycle. *See also Appendix A, p. 35 and B, p. 42.*

WARNING: Failure to confirm compatibility, properly install, operate and maintain any component or accessory can result in serious injury or death.

WARNING: Changing the components on your bike with other than genuine replacement parts may compromise the safety of your bicycle and may void the warranty. For example, replacement forks must have the same rake and steerer tube inner diameter as those originally fitted with the bicycle. Check with your dealer before changing the components on your bike.

3. FIT

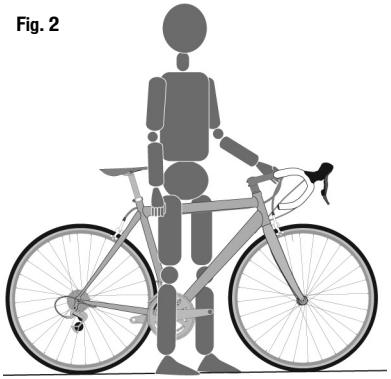
NOTE: Correct fit is an essential element of bicycling safety, performance and comfort. Making the adjustments to your bicycle which result in correct fit for your body and riding conditions requires experience, skill and special tools. Always have your dealer make the adjustments on your bicycle; or, if you have the experience, skill and tools, have your dealer check your work before riding.

WARNING: Make sure that the seat position is adjustable so that the feet of a seated rider can touch the ground. This warning is particularly important for children. If your bicycle does not fit properly, you may lose control and fall. If your new bike doesn't fit, ask your dealer to exchange it before you ride it.

A. Standover height

1. Diamond frame bicycles

Fig. 2



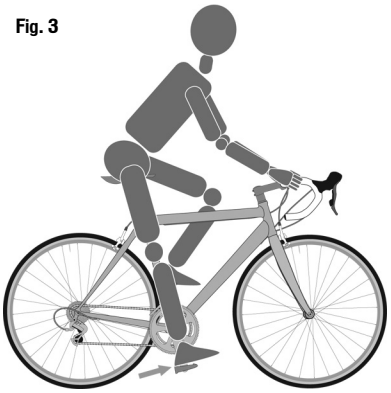
Standover height is the basic element of bike fit (see). It is the distance from the ground to the top of the bicycle's frame at that point where your crotch is when straddling the bike. To check for correct standover height, straddle the bike while wearing the kind of shoes in which you'll be riding, and bounce vigorously on your heels. If your crotch touches the frame, the bike is too big for you. Don't even ride the bike around the block. A bike which you ride only on paved surfaces and never take off-road should give you a minimum standover height clearance of two inches (5 cm). A bike that you'll ride on unpaved surfaces should give you a minimum of three inches (7.5 cm) of standover height clearance. And a bike that you'll use off road should give you four inches (10 cm) or more of clearance.

2. Step-through frame bicycles

Standover height does not apply to bicycles with step-through frames. Instead, the limiting dimension is determined by saddle height range. You must be able to adjust your saddle position as described in **B** without exceeding the limits set by the height of the top of the seat tube and the "Minimum Insertion" or "Maximum Extension" mark on the seat post.

B. Saddle position

Fig. 3



Correct saddle adjustment is an important factor in getting the most performance and comfort from your bicycle. If the saddle position is not comfortable for you, see your dealer.

The saddle can be adjusted in three directions:

1. Up and down adjustment. To check for correct saddle height (fig. 3):

- sit on the saddle;
- place one heel on a pedal;
- rotate the crank until the pedal with your heel on it is in the down position and the crank arm is parallel to the seat tube.

If your leg is not completely straight, your saddle height needs to be adjusted. If your hips must rock for the heel to reach the pedal, the saddle is too high. If your leg is bent at the knee with your heel on the pedal, the saddle is too low.

Ask your dealer to set the saddle for your optimal riding position and to show you how to make this adjustment. If you choose to make your own saddle height adjustment:

- loosen the seat post clamp
- raise or lower the seat post in the seat tube
- make sure the saddle is straight fore and aft
- re-tighten the seat post clamp to the recommended torque (Appendix D or the manufacturer's instructions).

Once the saddle is at the correct height, make sure that the seat post does not project from the frame beyond its "Minimum Insertion" or "Maximum Extension" mark (fig. 4).

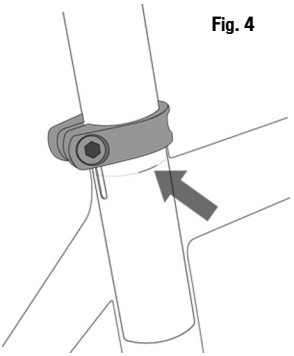


Fig. 4

NOTE: Some bicycles have a sight hole in the seat tube, the purpose of which is to make it easy to see whether the seat post is inserted in the seat tube far enough to be safe. If your bicycle has such a sight hole, use it instead of the "Minimum Insertion" or "Maximum Extension" mark to make sure the seat post is inserted in the seat tube far enough to be visible through the sight hole.

If your bike has an interrupted seat tube, as is the case on some suspension bikes, you must also make sure that the seat post is far enough into the frame so that you can touch it through the bottom of the interrupted seat tube with the tip of your finger without inserting your finger beyond its first knuckle. *(Also see NOTE above and fig. 5).*

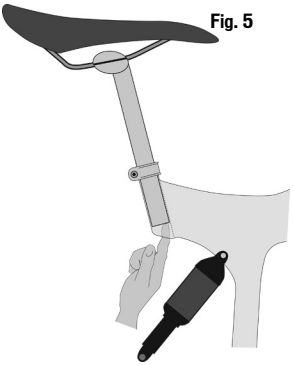


Fig. 5

WARNING: If your seat post is not inserted in the seat tube as described in B.1 above, the seat post may break, which could cause you to lose control and fall.

2. Front and back adjustment. The saddle can be adjusted forward or back to help you get the optimal position on the bike. Ask your dealer to set the saddle for your optimal riding position and to show you how to make this adjustment. If you choose to make your own front and back adjustment, make sure that the clamp mechanism is clamping on the straight part of the saddle rails and is not touching the curved part of the rails, and that you are using the recommended torque on the clamping fastener(s) (Appendix D or the manufacturer's instructions).

3. Saddle angle adjustment. Most people prefer a horizontal saddle; but some riders like the saddle nose angled up or down just a little. Your dealer can adjust saddle angle or teach you how to do it. If you choose to make your own saddle angle adjustment and you have a single bolt saddle clamp on your seat post, it is critical that you loosen the clamp bolt sufficiently to allow any serrations on the mechanism to disengage before changing the saddle's angle, and then that the serrations fully re-engage before you tighten the clamp bolt to the recommended torque (Appendix D or the manufacturer's instructions).

WARNING: When making saddle angle adjustments with a single bolt saddle clamp, always check to make sure that the serrations on the mating surfaces of the clamp are not worn. Worn serrations on the clamp can allow the saddle to move, causing you to lose control and fall.

Always tighten fasteners to the correct torque. Bolts that are too tight can stretch and deform. Bolts that are too loose can move and fatigue. Either mistake can lead to a sudden failure of the bolt, causing you to lose control and fall.

NOTE: If your bicycle is equipped with a suspension seat post, the suspension mechanism may require periodic service or maintenance. Ask your dealer for recommended service intervals for your suspension seat post.

Small changes in saddle position can have a substantial effect on performance and comfort. To find your best saddle position, make only one adjustment at a time.

WARNING: After any saddle adjustment, be sure that the saddle adjusting mechanism is properly seated and tightened before riding. A loose saddle clamp or seat post clamp can cause damage to the seat post, or can cause you to lose control and fall. A correctly tightened saddle adjusting mechanism will allow no saddle movement in any direction. Periodically check to make sure that the saddle adjusting mechanism is properly tightened.

If, in spite of carefully adjusting the saddle height, tilt and fore-and-aft position, your saddle is still uncomfortable, you may need a different saddle design. Saddles, like people, come in many different shapes, sizes and resilience. Your dealer can help you select a saddle which, when correctly adjusted for your body and riding style, will be comfortable.

WARNING: Some people have claimed that extended riding with a saddle which is incorrectly adjusted or which does not support your pelvic area correctly can cause short-term or long-term injury to nerves and blood vessels, or even impotence. If your saddle causes you pain, numbness or other discomfort, listen to your body and stop riding until you see your dealer about saddle adjustment or a different saddle.

C. Handlebar height and angle

Your bike is equipped either with a "threadless" stem, which clamps on to the outside of the steerer tube, or with a "quill" stem, which clamps inside the steerer tube by way of an expanding binder bolt. If you aren't absolutely sure which type of stem your bike has, ask your dealer.

If your bike has a "threadless" stem (fig. 6) your dealer may be able to change handlebar height by moving height adjustment spacers from below the stem to above the stem, or vice versa. Otherwise, you'll have to get a stem of different length or rise. Consult your dealer. Do not attempt to do this yourself, as it requires special knowledge.

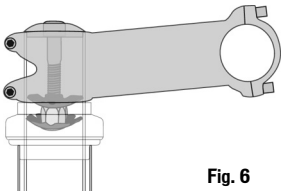


Fig. 6

If your bike has a "quill" stem (fig. 7) you can ask your dealer to adjust the handlebar height a bit by adjusting stem height.

A quill stem has an etched or stamped mark on its shaft which designates the stem's "Minimum Insertion" or "Maximum Extension". This mark must not be visible above the headset.

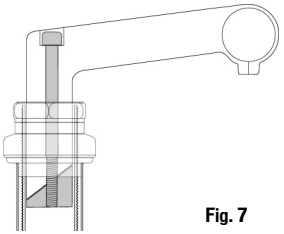


Fig. 7

WARNING: A quill stem's Minimum Insertion Mark must not be visible above the top of the headset. If the stem is extended beyond the Minimum Insertion Mark the stem may break or damage the fork's steerer tube, which could cause you to lose control and fall.

WARNING: On some bicycles, changing the stem or stem height can affect the tension of the front brake cable, locking the front brake or creating excess cable slack which can make the front brake inoperable. If the front brake pads move in towards the wheel rim or out away from the wheel rim when the stem or stem height is changed, the brakes must be correctly adjusted before you ride the bicycle.

Some bicycles are equipped with an adjustable angle stem. If your bicycle has an adjustable angle stem, ask your dealer to show you how to adjust if. Do not attempt to make the adjustment yourself, as changing stem angle may also require adjustments to the bicycle's controls.

WARNING: Always tighten fasteners to the correct torque. Bolts that are too tight can stretch and deform. Bolts that are too loose can move and fatigue. Either mistake can lead to a sudden failure of the bolt, causing you to lose control and fall.

Your dealer can also change the angle of the handlebar or bar end extensions.

WARNING: An insufficiently tightened stem clamp bolt, handlebar clamp bolt or bar end extension clamping bolt may compromise steering action, which could cause you to lose control and fall. Place the front wheel of the bicycle between your legs and attempt to twist the handlebar/stem assembly. If you can twist the stem in relation to the front wheel, turn the handlebars in relation to the stem, or turn the bar end extensions in relation to the handlebar, the bolts are insufficiently tightened.

WARNING: During use of aero extensions you will have less control over the bicycle. You will have a diminished ability to steer. You will also need to reset your hands to operate the brakes, which means your response to braking will take longer.

D. Control position adjustments

The angle of the brake and shift control levers and their position on the handlebars can be changed. Ask your dealer to make the adjustments for you. If you choose to make your own control lever angle adjustment, be sure to re-

tighten the clamp fasteners to the recommended torque (Appendix D or the manufacturer's instructions).

E. Brake reach

Many bikes have brake levers which can be adjusted for reach. If you have small hands or find it difficult to squeeze the brake levers, your dealer can either adjust the reach or fit shorter reach brake levers.

WARNING: The shorter the brake lever reach, the more critical it is to have correctly adjusted brakes, so that full braking power can be applied within available brake lever travel. Brake lever travel insufficient to apply full braking power can result in loss of control, which may result in serious injury or death.

4. TECH

It's important to your safety, performance and enjoyment to understand how things work on your bicycle. We urge you to ask your dealer how to do the things described in this section before you attempt them yourself, and that you have your dealer check your work before you ride the bike. If you have even the slightest doubt as to whether you understand something in this section of the Manual, talk to your dealer. *See also Appendix A, B, C and D.*

A. Wheels

Bicycle wheels are designed to be removable for easier transportation and for repair of a tire puncture. In most cases, the wheel axles are inserted into slots, called "dropouts" in the fork and frame, but some suspension mountain bikes use what is called a "through axle" wheel mounting system.

If you have a mountain bike equipped with through axle front or rear wheels, make sure that your dealer has given you the manufacturer's instructions, and follow those when installing or removing a through axle wheel. If you don't know what a through axle is, ask your dealer.

Wheels are secured in one of three ways:

- A hollow axle with a shaft ("skewer") running through it which has an adjustable tension nut on one end and an over-center cam on the other (cam action system, fig.8 a & b)

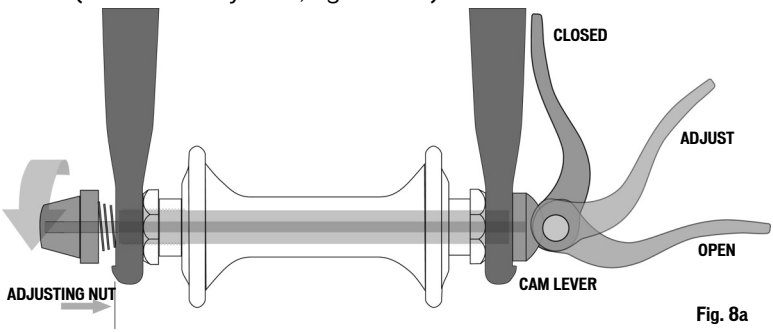


Fig. 8a

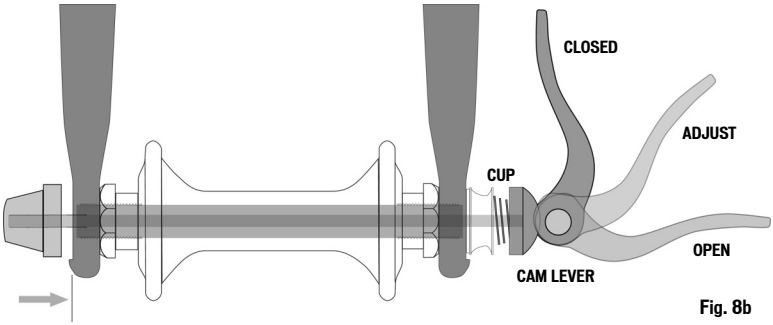


Fig. 8b

- A hollow axle with a shaft ("skewer") running through it which has a nut on one end and a fitting for a hex key, lock lever or other tightening device on the other (through bolt, fig. 9)

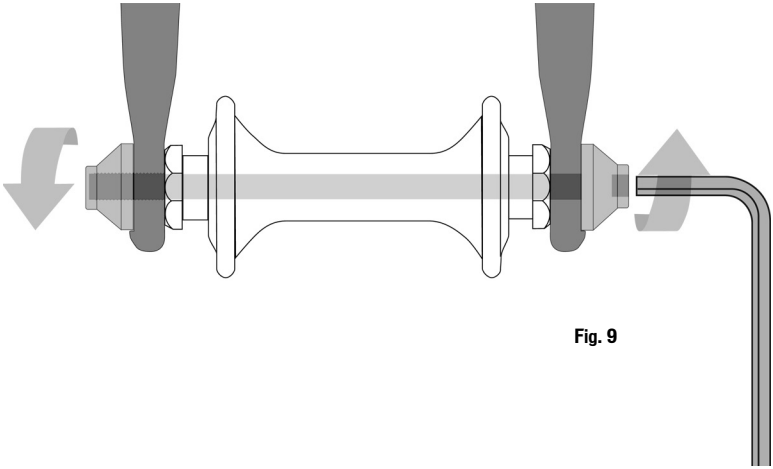


Fig. 9

- Hex nuts or hex key bolts which are threaded on to or into the hub axle (bolt-on wheel, fig. 10)

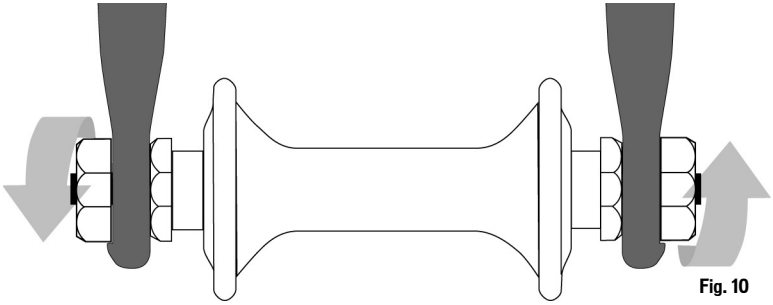


Fig. 10

Your bicycle may be equipped with a different securing method for the front wheel than for the rear wheel. Discuss the wheel securing method for your bicycle with your dealer.

It is very important that you understand the type of wheel securing method on your bicycle, that you know how to secure the wheels correctly, and that you know how to apply the correct clamping force that safely secures

the wheel. Ask your dealer to instruct you in correct wheel removal and installation, and ask him to give you any available manufacturer's instructions.

WARNING: Riding with an improperly secured wheel can allow the wheel to wobble or fall off the bicycle, which can cause serious injury or death. Therefore, it is essential that you:

1. Ask your dealer to help you make sure you know how to install and remove your wheels safely.

2. Understand and apply the correct technique for clamping your wheel in place.

3. Each time, before you ride the bike, check that the wheel is securely clamped.

4. The clamping action of a correctly secured wheel must emboss the surfaces of the dropouts.

1. Front Wheel Secondary Retention Devices

Most bicycles have front forks which utilize a secondary wheel retention device to reduce the risk of the wheel disengaging from the fork if the wheel is incorrectly secured. Secondary retention devices are not a substitute for correctly securing your front wheel.

Secondary retention devices fall into two basic categories:

a. The clip-on type is a part which the manufacturer adds to the front wheel hub or front fork.

b. The integral type is molded, cast or machined into the outer faces of the front fork dropouts.

Ask your dealer to explain the particular secondary retention device on your bike.

WARNING: Do not remove or disable the secondary retention device. As its name implies, it serves as a back-up for a critical adjustment. If the wheel is not secured correctly, the secondary retention device can reduce the risk of the wheel disengaging from the fork. Removing or disabling the secondary retention device may also void the warranty.

Secondary retention devices are not a substitute for correctly securing your wheel. Failure to properly secure the wheel can cause the wheel to wobble or disengage, which could cause you to loose control and fall, resulting in serious injury or death.

2. Wheels with cam action systems

There are currently two types of over-center cam wheel retention mechanisms: the traditional over-center cam (fig. 8a) and the cam-and-cup system (fig. 8b). Both use an over-center cam action to clamp the bike's wheel in place. Your bicycle may have a cam-and-cup front wheel retention system and a traditional rear wheel cam action system.

a. Adjusting the traditional cam action mechanism (fig. 8a)

The wheel hub is clamped in place by the force of the over-center cam pushing against one dropout and pulling the tension adjusting nut, by way of the skewer, against the other dropout. The amount of clamping force is controlled by the tension adjusting nut. Turning the tension adjusting nut clockwise while keeping the cam lever from rotating increases clamping force; turning it counterclockwise while keeping the cam lever from rotating reduces clamping force. Less than half a turn of the tension adjusting nut can make the difference between safe clamping force and unsafe clamping force.

WARNING: The full force of the cam action is needed to clamp the wheel securely. Holding the nut with one hand and turning the lever like a wing nut with the other hand until everything is as tight as you can get it will not clamp a cam action wheel safely in the dropouts. See also the first WARNING in this Section, p. 18.

b. Adjusting the cam-and-cup mechanism (fig. 8b)

The cam-and-cup system on your front wheel will have been correctly adjusted for your bicycle by your dealer. Ask your dealer to check the adjustment every six months. **Do not use a cam-and-cup front wheel on any bicycle other than the one for which your dealer adjusted it.**

3. Removing and Installing wheels

WARNING: If your bike is equipped with a hub brake such as a rear coaster brake, front or rear drum, band or roller brake; or if it has an internal gear rear hub, do not attempt to remove the wheel. The removal and re-installation of most hub brakes and internal gear hubs requires special knowledge. Incorrect removal or assembly can result in brake or gear failure, which can cause you to lose control and fall.

CAUTION: If your bike has a disc brake, exercise care in touching the rotor or caliper. Disc rotors have sharp edges, and both rotor and caliper can get very hot during use.

a. Removing a disk brake or rim brake Front Wheel

(1) If your bike has rim brakes, disengage the brake's quick-release mechanism to increase the clearance between the tire and the brake pads (See Section 4.C fig. 11 through 15).

(2) If your bike has cam action front wheel retention, move the cam lever from the locked or CLOSED position to the OPEN position (figs. 8a & b). If your bike has through bolt or bolt-on front wheel retention, loosen the fastener(s) a few turns counter-clockwise using an appropriate wrench, lock key or the integral lever.

(3) If your front fork has a clip-on type secondary retention device, disengage it and go to step (4). If your front fork has an integral secondary retention device, and a traditional cam action system (fig. 8a) loosen the tension adjusting nut enough to allow removing the wheel from the dropouts. If your front wheel uses a cam-and-cup system, (fig. 8b) squeeze the cup and cam lever together while removing the wheel. No rotation of any part is necessary with the cam-and-cup system.

(4) You may need to tap the top of the wheel with the palm of your hand to release the wheel from the front fork.

b. Installing a disk brake or rim brake Front Wheel

CAUTION: If your bike is equipped with a front disk brake, be careful not to damage the disk, caliper or brake pads when re-inserting the disk into the caliper. Never activate a disk brake's control lever unless the disk is correctly inserted in the caliper. See also Section 4.C.

(1) If your bike has cam action front wheel retention, move the cam lever so that it curves away from the wheel (fig. 8b). This is the OPEN position. If your bike has through bolt or bolt-on front wheel retention, go to the next step.

(2) With the steering fork facing forward, insert the wheel between the fork blades so that the axle seats firmly at the top of the fork dropouts. The cam lever, if there is one, should be on rider's left side of the bicycle (fig. 8a & b). If your bike has a clip-on type secondary retention device, engage it.

(3) If you have a traditional cam action mechanism: holding the cam lever in the ADJUST position with your right hand, tighten the tension adjusting nut with your left hand until it is finger tight against the fork dropout (fig. 8a). If you have a cam-and-cup system: the nut and cup (fig. 8b) will have snapped into the recessed area of the fork dropouts and no adjustment should be required.

(4) While pushing the wheel firmly to the top of the slots in the fork dropouts, and at the same time centering the wheel rim in the fork:

(a) With a cam action system, move the cam lever upwards and swing it into the CLOSED position (fig. 8a & b). The lever should now be parallel to the fork blade and curved toward the wheel. To apply enough clamping force, you should have to wrap your fingers around the fork blade for leverage, and the lever should leave a clear imprint in the palm of your hand.

(b) With a through-bolt or bolt-on system, tighten the fasteners to the torque specifications in Appendix D or the hub manufacturer's instructions.

NOTE: If, on a traditional cam action system, the lever cannot be pushed all the way to a position parallel to the fork blade, return the lever to the OPEN position. Then turn the tension adjusting nut counterclockwise one-quarter turn and try tightening the lever again.

WARNING: Securely clamping the wheel with a cam action retention device takes considerable force. If you can fully close the cam lever without wrapping your fingers around the fork blade for leverage, the lever does not leave a clear imprint in the palm of your hand, and the serrations on the wheel fastener do not emboss the surfaces of the dropouts, the tension is insufficient. Open the lever; turn the tension adjusting nut clockwise a quarter turn; then try again. See also the first WARNING in this Section, p. 18.

(5) If you disengaged the brake quick-release mechanism in 3. a. (1) above, re-engage it to restore correct brake pad-to-rim clearance.

(6) Spin the wheel to make sure that it is centered in the frame and clears the brake pads; then squeeze the brake lever and make sure that the brakes are operating correctly.

c. Removing a disk brake or rim brake Rear Wheel

(1) If you have a multi-speed bike with a derailleur gear system: shift the rear derailleur to high gear (the smallest, outermost rear sprocket).

If you have an internal gear rear hub, consult your dealer or the hub manufacturer's instructions before attempting to remove the rear wheel.

If you have a single-speed bike with rim or disk brake, go to step (4) below.

(2) If your bike has rim brakes, disengage the brake's quick-release mechanism to increase the clearance between the wheel rim and the brake pads (see Section 4.C, figs. 11 through 15).

(3) On a derailleur gear system, pull the derailleur body back with your right hand.

(4) With a cam action mechanism, move the quick-release lever to the OPEN position (fig. 8b). With a through bolt or bolt on mechanism, loosen the fastener(s) with an appropriate wrench, lock lever or integral lever; then push the wheel forward far enough to be able to remove the chain from the rear sprocket.

(5) Lift the rear wheel off the ground a few inches and remove it from the rear dropouts.

d. Installing a disk brake or rim brake Rear Wheel

WARNING: If your bike is equipped with a rear disk brake, be careful not to damage the disk, caliper or brake pads when re-inserting the disk into the caliper. Never activate a disk brake's control lever unless the disk is correctly inserted in the caliper.

(1) With a cam action system, move the cam lever to the OPEN position (see fig. 8 a & b). The lever should be on the side of the wheel opposite the derailleur and freewheel sprockets.

(2) On a derailleur bike, make sure that the rear derailleur is still in its outermost, high gear, position; then pull the derailleur body back with your right hand. Put the chain on top of the smallest freewheel sprocket.

(3) On single-speed, remove the chain from the front sprocket, so that you have plenty of slack in the chain. Put the chain on the rear wheel sprocket.

(4) Then, insert the wheel into the frame dropouts and pull it all the way in to the dropouts.

(5) On a single speed or an internal gear hub, replace the chain on the chainring; pull the wheel back in the dropouts so that it is straight in the frame and the chain has about 6mm (1/4 inches) of up-and-down play.

(6) With a cam action system, move the cam lever upwards and swing it into the CLOSED position (fig. 8 a & b). The lever should now be parallel to the seat stay or chain stay and curved toward the wheel. To apply enough clamping force, you should have to wrap your fingers around the fork blade for leverage, and the lever should leave a clear imprint in the palm of your hand.

(7) With a through-bolt or bolt-on system, tighten the fasteners to the torque

specifications in Appendix D or the hub manufacturer's instructions.

NOTE: If, on a traditional cam action system, the lever cannot be pushed all the way to a position parallel to the seat stay or chain stay, return the lever to the OPEN position. Then turn the tension adjusting nut counterclockwise one-quarter turn and try tightening the lever again.

WARNING: Securely clamping the wheel with a cam action retention device takes considerable force. If you can fully close the cam lever without wrapping your fingers around the seat stay or chain stay for leverage, the lever does not leave a clear imprint in the palm of your hand, and the serrations on the wheel fastener do not emboss the surfaces of the dropouts, the tension is insufficient. Open the lever; turn the tension adjusting nut clockwise a quarter turn; then try again. See also the first WARNING in this Section, p. 18.

(8) If you disengaged the brake quick-release mechanism in 3. c. (2) above, re-engage it to restore correct brake pad-to-rim clearance.

(9) Spin the wheel to make sure that it is centered in the frame and clears the brake pads; then squeeze the brake lever and make sure that the brakes are operating correctly.

B. Seat post cam action clamp

Some bikes are equipped with a cam action seat post binder. The seat post cam action binder works exactly like the traditional wheel cam action fastener (Section 4.A.2) While a cam action binder looks like a long bolt with a lever on one end and a nut on the other, the binder uses an over-center cam action to firmly clamp the seat post (see fig. 8a).

WARNING: Riding with an improperly tightened seat post can allow the saddle to turn or move and cause you to lose control and fall. Therefore:

1. Ask your dealer to help you make sure you know how to correctly clamp your seat post.

2. Understand and apply the correct technique for clamping your seat post.

3. Before you ride the bike, first check that the seat post is securely clamped.

Adjusting the seat post cam action mechanism

The action of the cam squeezes the seat collar around the seat post to hold the seat post securely in place. The amount of clamping force is controlled by the tension adjusting nut. Turning the tension adjusting nut clockwise while keeping the cam lever from rotating increases clamping force; turning it counterclockwise while keeping the cam lever from rotating reduces clamping force. Less than half a turn of the tension adjusting nut can make the difference between safe and unsafe clamping force.

WARNING: The full force of the cam action is needed to clamp the seat post securely. Holding the nut with one hand and turning the lever like a wing nut with the other hand until everything is as tight as you can get it will not clamp the seat post safely.

WARNING: If you can fully close the cam lever without wrapping your fingers around the seat post or a frame tube for leverage, and the lever does not leave a clear imprint in the palm of your hand, the tension is insufficient. Open the lever; turn the tension adjusting nut clockwise a quarter turn; then try again.

C. Brakes

There are three general types of bicycle brakes: rim brakes, which operate by squeezing the wheel rim between two brake pads; disc brakes, which operate by squeezing a hub-mounted disc between two brake pads; and internal hub brakes. All three can be operated by way of a handlebar mounted lever. On some models of bicycle, the internal hub brake is operated by pedaling backwards. This is called a Coaster Brake and is described in Appendix C.

WARNING:

1. Riding with improperly adjusted brakes, worn brake pads, or wheels on which the rim wear mark is visible is dangerous and can result in serious injury or death.

2. Applying brakes too hard or too suddenly can lock up a wheel, which could cause you to lose control and fall. Sudden or excessive application of the front brake may pitch the rider over the handlebars, which may result in serious injury or death.

3. Some bicycle brakes, such as disc brakes (fig. 11) and linear-pull brakes (fig. 12), are extremely powerful. Take extra care in becoming familiar with these brakes and exercise particular care when using them.

4. Some bicycle brakes are equipped with a brake force modulator, a small, cylindrical device through which the brake control cable runs and which is designed to provide a more progressive application of braking force. A modulator makes the initial brake lever force more gentle, progressively increasing force until full force is achieved. If your bike is equipped with a brake force modulator, take extra care in becoming familiar with its performance characteristics.

5. Disc brakes can get extremely hot with extended use. Be careful not to touch a disc brake until it has had plenty of time to cool.

6. See the brake manufacturer's instructions for operation and care of your brakes, and for when brake pads must be replaced. If you do not have the manufacturer's instructions, see your dealer or contact the brake manufacturer.

7. If replacing worn or damaged parts, use only manufacturer-approved genuine replacement parts.

1. Brake controls and features

It's very important to your safety that you learn and remember which brake lever controls which brake on your bike. Traditionally, the right brake lever controls the rear brake and the left brake lever controls the front brake; but, to make sure your bike's brakes are set up this way, squeeze one brake lever and look to see which brake, front or rear, engages. Now do the same with the other brake lever.

Make sure that your hands can reach and squeeze the brake levers comfortably. If your hands are too small to operate the levers comfortably, consult your dealer before riding the bike. The lever reach may be adjustable; or you may need a different brake lever design.

Most rim brakes have some form of quick-release mechanism to allow the brake pads to clear the tire when a wheel is removed or reinstalled. When the brake quick release is in the open position, the brakes are inoperative. Ask your dealer to make sure that you understand the way the brake quick release works on your bike (see figs. 12, 13. 14 & 15) and check each time to make sure both brakes work correctly before you get on the bike.

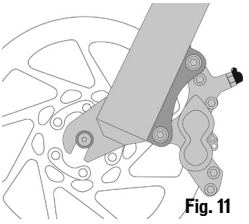


Fig. 11

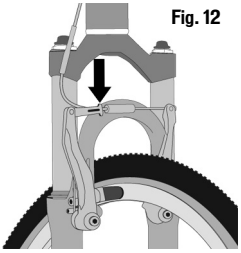


Fig. 12

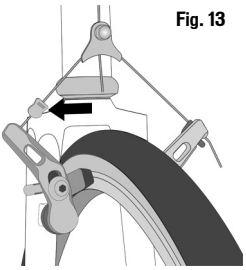


Fig. 13

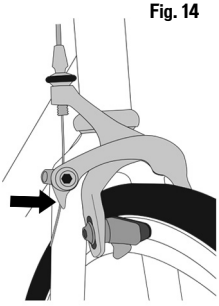


Fig. 14

2. How brakes work

The braking action of a bicycle is a function of the friction between the braking surfaces. To make sure that you have maximum friction available, keep your wheel rims and brake pads or the disk rotor and caliper clean and free of dirt, lubricants, waxes or polishes.

When you apply one or both brakes, the bike begins to slow, but your body wants to continue at the speed at which it was going. This causes a transfer of weight to the front wheel (or, under heavy braking, around the front wheel hub, which could send you flying over the handlebars).

A wheel with more weight on it will accept greater brake pressure before lockup; a wheel with less weight will lock up with less brake pressure. So, as you apply brakes and your weight is transferred forward, you need to shift your body toward the rear of the bike, to transfer weight back on to the rear wheel; and at the same time, you need to both decrease rear braking and increase front braking force. This is even more important on descents, because descents shift weight forward.

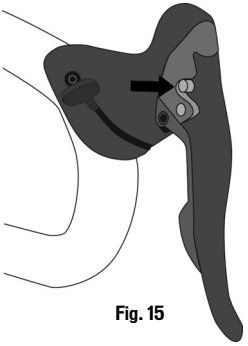


Fig. 15

Two keys to effective speed control and safe stopping are controlling wheel lockup and weight transfer. This weight transfer is even more pronounced if your bike has a front suspension fork. Front suspension "dips" under braking, increasing the weight transfer (see also Section 4.F). Practice braking and weight transfer techniques where there is no traffic or other hazards and distractions.

Everything changes when you ride on loose surfaces or in wet weather. It will take longer to stop on loose surfaces or in wet weather. Tire adhesion is reduced, so the wheels have less cornering and braking traction and can lock up with less brake force. Moisture or dirt on the brake pads reduces their ability to grip. The way to maintain control on loose or wet surfaces is to go more slowly.

D. Shifting gears

Your multi-speed bicycle will have a derailleur drivetrain (see 1. below), an internal gear hub drivetrain (see 2. below) or, in some special cases, a combination of the two.

1. How a derailleur drivetrain works

If your bicycle has a derailleur drivetrain, the gear-changing mechanism will have:

- a rear cassette or freewheel sprocket cluster
- a rear derailleur
- usually a front derailleur
- one or two shifters
- one, two or three front sprockets called chainrings
- a drive chain

a. Shifting Gears

There are several different types and styles of shifting controls: levers, twist grips, triggers, combination shift/brake controls and push-buttons. Ask your dealer to explain the type of shifting controls that are on your bike, and to show you how they work.

The vocabulary of shifting can be pretty confusing. A downshift is a shift to a "lower" or "slower" gear, one which is easier to pedal. An upshift is a shift to a "higher" or "faster", harder to pedal gear. What's confusing is that what's happening at the front derailleur is the opposite of what's happening at the rear derailleur (for details, read the instructions on Shifting the Rear Derailleur and Shifting the Front Derailleur below). For example, you can select a gear which will make pedaling easier on a hill (make a downshift) in one of two ways: shift the chain down the gear "steps" to a smaller gear at the front, or up the gear "steps" to a larger gear at the rear. So, at the rear gear cluster, what is called a downshift looks like an upshift. The way to keep things straight is to remember that shifting the chain in towards the centerline of the bike is for accelerating and climbing and is called a downshift. Moving the chain out or away from the centerline of the bike is for speed and is called an upshift.

Whether upshifting or downshifting, the bicycle derailleur system design requires that the drive chain be moving forward and be under at least some tension. A derailleur will shift only if you are pedaling forward.

CAUTION: Never move the shifter while pedaling backward, nor pedal backwards immediately after having moved the shifter. This could jam the chain and cause serious damage to the bicycle.

b. Shifting the Rear Derailleur

The rear derailleur is controlled by the right shifter.

The function of the rear derailleur is to move the drive chain from one gear sprocket to another. The smaller sprockets on the gear cluster produce higher gear ratios. Pedaling in the higher gears requires greater pedaling effort, but takes you a greater distance with each revolution of the pedal cranks. The larger sprockets produce lower gear ratios. Using them requires less pedaling effort, but takes you a shorter distance with each pedal crank revolution. Moving the chain from a smaller sprocket of the gear cluster to a larger sprocket results in a downshift. Moving the chain from a larger sprocket to a smaller sprocket results in an upshift. In order for the derailleur to move the chain from one sprocket to another, the rider must be pedaling forward.

c. Shifting the Front Derailleur:

The front derailleur, which is controlled by the left shifter, shifts the chain between the larger and smaller chainrings. Shifting the chain onto a smaller chainring makes pedaling easier (a downshift). Shifting to a larger chainring makes pedaling harder (an upshift).

d. Which gear should I be in?

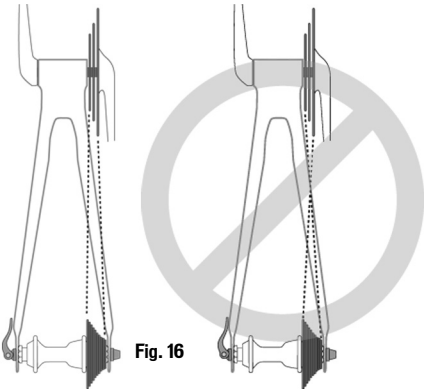


Fig. 16

The combination of largest rear and smallest front gears (fig. 16) is for the steepest hills. The smallest rear and largest front combination is for the greatest speed. It is not necessary to shift gears in sequence. Instead, find the "starting gear" which is right for your level of ability – a gear which is hard enough for quick acceleration but easy enough to let you start from a stop without wobbling – and experiment with upshifting and downshifting to get a feel for the different gear combinations. At first, practice shifting where there are no obstacles, hazards or other traffic, until you've built up your confidence. Learn to anticipate the need to shift, and shift to a lower gear *before* the hill gets too steep. If you have difficulties with shifting, the problem could be mechanical adjustment. See your dealer for help.

WARNING: Never shift a derailleur onto the largest or the smallest sprocket if the derailleur is not shifting smoothly. The derailleur may be out of adjustment and the chain could jam, causing you to lose control and fall.

e. What if it won't shift gears?

If moving the shift control one click repeatedly fails to result in a smooth shift to the next gear chances are that the mechanism is out of adjustment. Take the bike to your dealer to have it adjusted.

2. How an internal gear hub drivetrain works

If your bicycle has an internal gear hub drivetrain, the gear changing mechanism will consist of:

- a 3, 5, 7, 8, 12 speed or possibly an infinitely variable internal gear hub
- one, or sometimes two shifters
- one or two control cables
- one front sprocket called a chainring
- a drive chain

a. Shifting internal gear hub gears

Shifting with an internal gear hub drivetrain is simply a matter of moving the shifter to the indicated position for the desired gear ratio. After you have moved the shifter to the gear position of your choice, ease the pressure on the pedals for an instant to allow the hub to complete the shift.

b. Which gear should I be in?

The numerically lowest gear (1) is for the steepest hills. The numerically largest gear is for the greatest speed.

Shifting from an easier, "slower" gear (like 1) to a harder, "faster" gear (like 2 or 3) is called an upshift. Shifting from a harder, "faster" gear to an easier, "slower" gear is called a downshift. It is not necessary to shift gears in sequence. Instead, find the "starting gear" for the conditions – a gear which is hard enough for quick acceleration but easy enough to let you start from a stop without wobbling – and experiment with upshifting and downshifting to get a feel for the different gears. At first, practice shifting where there are no obstacles, hazards or other traffic, until you've built up your confidence. Learn to anticipate the need to shift, and shift to a lower gear *before* the hill gets too steep. If you have difficulties with shifting, the problem could be mechanical adjustment. See your dealer for help.

c. What if it won't shift gears?

If moving the shift control one click repeatedly fails to result in a smooth shift to the next gear chances are that the mechanism is out of adjustment. Take the bike to your dealer to have it adjusted.

3. How to adjust a single-speed drivetrain

If your bicycle has a single speed drivetrain, the chain requires tension to make sure the chain doesn't come off the sprocket or chainring. Chain tension requires a fine-tuned adjustment. We recommend that chain tension be adjusted by your dealer.

E. Pedals

1. Toe Overlap is when your toe can touch the front wheel when you turn the handlebars to steer while a pedal is in the forwardmost position. This is common on small-framed bicycles, and is avoided by keeping the inside pedal up and the outside pedal down when making sharp turns. On any bicycle, this technique will also prevent the inside pedal from striking the ground in a turn.

WARNING: BMX pedals are designed to provide greater grip capability of the pedal tread surface than that provided by an ordinary pedal. This can result in the pedal tread surface being very rough and containing sharp edges. To avoid injury, Riders should therefore not ride barefooted and should ride wearing a pair of shoes with thick soles to ensure adequate safety protection.

WARNING: Toe Overlap could cause you to lose control and fall. Ask your dealer to help you determine if the combination of frame size, crank arm length, pedal design and shoes you will use results in pedal overlap. Replacement of crank arms or tires can result in a reduction in toe overlap clearance. Whether you have overlap or not, you must keep the inside pedal up and the outside pedal down when making sharp turns.

2. Some bicycles come equipped with pedals that have sharp and potentially dangerous surfaces. These surfaces are designed to add safety by increasing grip between the rider's shoe and the pedal. If your bicycle has this type of high-performance pedal, you must take extra care to avoid serious injury from the pedals' sharp surfaces. Based on your riding style or skill level, you may prefer a less aggressive pedal design, or chose to ride with shin pads. Your dealer can show you a number of options and make suitable recommendations.

3. Toeclips and straps are a means to keep feet correctly positioned and engaged with the pedals. The toeclip positions the ball of the foot over the pedal spindle, which gives maximum pedaling power. The toe strap, when tightened, keeps the foot engaged throughout the rotation cycle of the pedal. While toeclips and straps give some benefit with any kind of shoe, they work most effectively with cycling shoes designed for use with toeclips. Your dealer can explain how toeclips and straps work. Shoes with deep treaded soles or welts which might make it more difficult for you to insert or remove your foot should not be used with toeclips and straps.

WARNING: Getting into and out of pedals with toeclips and straps requires skill which can only be acquired with practice. Until it becomes a reflex action, the technique requires concentration which can distract your attention and cause you to lose control and fall. Practice the use of toeclips and straps where there are no obstacles, hazards or traffic. Keep the straps loose, and don't tighten them until your technique and confidence in getting in and out of the pedals warrants it. Never ride in traffic with your toe straps tight.

4. Clipless pedals (sometimes called "step-in pedals") are another means to keep feet securely in the correct position for maximum pedaling efficiency. They have a plate, called a "cleat," on the sole of the shoe, which clicks into a mating spring-loaded fixture on the pedal. They only engage or disengage with a very specific motion which must be practiced until it becomes instinctive. Clipless pedals require shoes and cleats which are compatible with the make and model pedal being used.

Many clipless pedals are designed to allow the rider to adjust the amount of force needed to engage or disengage the foot. Follow the pedal manufacturer's

instructions, or ask your dealer to show you how to make this adjustment. Use the easiest setting until engaging and disengaging becomes a reflex action, but always make sure that there is sufficient tension to prevent unintended release of your foot from the pedal.

WARNING: Clipless pedals are intended for use with shoes specifically made to fit them and are designed to firmly keep the foot engaged with the pedal. Do not use shoes which do not engage the pedals correctly.

Practice is required to learn to engage and disengage the foot safely. Until engaging and disengaging the foot becomes a reflex action, the technique requires concentration which can distract your attention and cause you to lose control and fall. Practice engaging and disengaging clipless pedals in a place where there are no obstacles, hazards or traffic; and be sure to follow the pedal manufacturer's setup and service instructions. If you do not have the manufacturer's instructions, see your dealer or contact the manufacturer.

F. Bicycle Suspension

Many bicycles are equipped with suspension systems. There are many different types of suspension systems – too many to deal with individually in this Manual. If your bicycle has a suspension system of any kind, be sure to read and follow the suspension manufacturer's setup and service instructions. If you do not have the manufacturer's instructions, see your dealer or contact the manufacturer.

WARNING: Failure to maintain, check and properly adjust the suspension system may result in suspension malfunction, which may cause you to lose control and fall.

If your bike has suspension, the increased speed you may develop also increases your risk of injury. For example, when braking, the front of a suspended bike dips. You could lose control and fall if you do not have experience with this system. Learn to handle your suspension system safely. See also Section 4.C.

WARNING: Changing suspension adjustment can change the handling and braking characteristics of your bicycle. Never change suspension adjustment unless you are thoroughly familiar with the suspension system manufacturer's instructions and recommendations, and always check for changes in the handling and braking characteristics of the bicycle after a suspension adjustment by taking a careful test ride in a hazard-free area.

Suspension can increase control and comfort by allowing the wheels to better follow the terrain. This enhanced capability may allow you to ride faster; but you must not confuse the enhanced capabilities of the bicycle with your own capabilities as a rider. Increasing your skill will take time and practice. Proceed carefully until you have learned to handle the full capabilities of your bike.

WARNING: Not all bicycles can be safely retrofitted with some types of suspension systems. Before retrofitting a bicycle with any suspension, check with the bicycle's manufacturer to make sure that what you want to do is compatible with the bicycle's design. Failing to do so can result in catastrophic frame failure.

G. Tires and Tubes

1. Tires

Bicycle tires are available in many designs and specifications, ranging from general-purpose designs to tires designed to perform best under very specific weather or terrain conditions. If, once you've gained experience with your new bike, you feel that a different tire might better suit your riding needs, your dealer can help you select the most appropriate design.

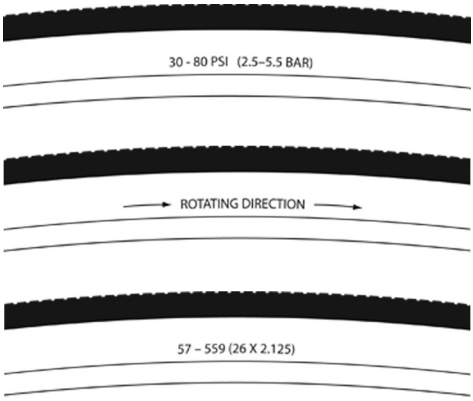


Fig. 17

The size, pressure rating, and on some high-performance tires the specific recommended use, are marked on the sidewall of the tire (see fig. 17). The part of this information which is most important to you is Tire Pressure.

Most Specialized bicycle tires are covered by pressure rating ranges based on tire size, however, certain tires have different pressure ranges based on the intended use of the tire. To determine the correct tire pressure range for a specific tire, please refer to the tire pressure range specified on the sidewall of the tire, or refer to www.specialized.com for a list of tire pressures by tire model.

TYPE	SIZE	PSI	BAR	KILOPASCALS
Mountain	26" / 29"	35-65	2.5-4.5	241-448
Road	700 x 23/25c	110-125	7.5-8.5	758-862
City	700 x 28/30c	85-95	6.0-6.5	586-655
City	700 x 32-38c	75-100	5.0-7.0	517-689
City	700 x 42-50c	50-100	3.5-7.0	345-689
Children	12"/16"/20"/24"	35-65	2.5-4.5	241-448

WARNING: Never inflate a tire beyond the maximum pressure marked on the tire's sidewall. Exceeding the recommended maximum pressure may blow the tire off the rim, which could cause damage to the bike and injury to the rider and bystanders.

The best and safest way to inflate a bicycle tire to the correct pressure is with a bicycle pump which has a built-in pressure gauge.

WARNING: There is a safety risk in using gas station air hoses or other air compressors. They are not made for bicycle tires. They move a large volume of air very rapidly, and will raise the pressure in your tire very rapidly, which could cause the tube to explode.

Tire pressure is given either as maximum pressure or as a pressure range. How a tire performs under different terrain or weather conditions depends largely on tire pressure. Inflating the tire to near its maximum recommended pressure gives the lowest rolling resistance; but also produces the harshest ride. High pressures work best on smooth, dry pavement.

Very low pressures, at the bottom of the recommended pressure range, give the best performance on smooth, slick terrain such as hard-packed clay, and on deep, loose surfaces such as deep, dry sand.

Tire pressure that is too low for your weight and the riding conditions can cause a puncture of the tube by allowing the tire to deform sufficiently to pinch the inner tube between the rim and the riding surface.

CAUTION: Pencil type automotive tire gauges can be inaccurate and should not be relied upon for consistent, accurate pressure readings. Instead, use a high quality dial gauge.

Ask your dealer to recommend the best tire pressure for the kind of riding you will most often do, and have the dealer inflate your tires to that pressure. Then, check inflation as described in Section 1.C so you'll know how correctly inflated tires should look and feel when you don't have access to a gauge. Some tires may need to be brought up to pressure every week or two, so it is important to check your tire pressures before every ride.

Some special high-performance tires have unidirectional treads: their tread pattern is designed to work better in one direction than in the other. The sidewall marking of a unidirectional tire will have an arrow showing the correct rotation direction. If your bike has unidirectional tires, be sure that they are mounted to rotate in the correct direction.

2. Tire Valves

There are primarily two kinds of bicycle tube valves: The Schraeder Valve and the Presta Valve. The bicycle pump you use must have the fitting appropriate to the valve stems on your bicycle.

The Schraeder valve (fig. 18a) is like the valve on a car tire. To inflate a Schraeder valve tube, remove the valve cap and clamp the pump fitting onto the end of the valve stem. To let air out of a Schraeder valve, depress the pin in the end of the valve stem with the end of a key or other appropriate object.

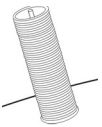


Fig. 18a

The Presta valve (fig. 18b) has a narrower diameter and is only found on bicycle tires. To inflate a Presta valve tube using a Presta headed bicycle pump, remove the valve cap; unscrew (counterclockwise) the valve stem lock nut; and push down on the valve stem to free it up. Then push the pump head on to the valve head, and inflate. To inflate a Presta valve with a Schraeder pump fitting, you'll need a Presta adapter (available at your bike shop) which screws on to the valve stem once you've freed up the valve. The adapter

Fig. 18b

fits into the Schraeder pump fitting. Close the valve after inflation. To let air out of a Presta valve, open up the valve stem lock nut and depress the valve stem.

WARNING: We highly recommend that you carry a spare inner tube when you ride your bike. Patching a tube is an emergency repair. If you do not apply the patch correctly or apply several patches, the tube can fail, resulting in possible tube failure, which could cause you to loose control and fall. Replace a patched tube as soon as possible.

5. SERVICE

WARNING: Technological advances have made bicycles and bicycle components more complex, and the pace of innovation is increasing. It is impossible for this manual to provide all the information required to properly repair and/or maintain your bicycle. In order to help minimize the chances of an accident and possible injury, it is critical that you have any repair or maintenance which is not specifically described in this manual performed by your dealer. Equally important is that your individual maintenance requirements will be determined by everything from your riding style to geographic location. Consult your dealer for help in determining your maintenance requirements.

WARNING: Many bicycle service and repair tasks require special knowledge and tools. Do not begin any adjustments or service on your bicycle until you have learned from your dealer how to properly complete them. We recommend that significant mechanical repairs should be carried out by a qualified bicycle mechanic. Improper adjustment or service may result in damage to the bicycle or in an accident which can cause serious injury or death.

If you want to learn to do major service and repair work on your bike:

1. Ask your dealer for copies of the manufacturer's installation and service instructions for the components on your bike, or contact the component manufacturer.

2. Ask your dealer to recommend a book on bicycle repair.

3. Ask your dealer about the availability of bicycle repair courses in your area.

We recommend that you ask your dealer to check the quality of your work the first time you work on something and before you ride the bike, just to make sure that you did everything correctly. Since that will require the time of a mechanic, there may be a modest charge for this service.

We also recommend that you ask your dealer for guidance on what spare parts, such as inner tubes, light bulbs, etc. it would be appropriate for you to have once you have learned how to replace such parts when they require replacement.

A. Service Intervals

Some service and maintenance can and should be performed by the owner, and require no special tools or knowledge beyond what is presented in this manual.

The following are examples of the type of service you should perform yourself. All other service, maintenance and repair should be performed in a properly equipped facility by a qualified bicycle mechanic using the correct tools and procedures specified by the manufacturer.

1. Break-in Period: Your bike will last longer and work better if you break it in before riding it hard. Control cables and wheel spokes may stretch or "seat" when a new bike is first used and may require readjustment by your dealer. Your Mechanical Safety Check (Section 1.C) will help you identify some things that need readjustment. But even if everything seems fine to you, it's best to take your bike back to the dealer for a checkup. Dealers typically suggest you bring the bike in for a 30 day checkup. Another way to judge when it's time for the first checkup is to bring the bike in after three to five hours of hard off-road use, or about 10 to 15 hours of on-road or more casual off-road use. But if you think something is wrong with the bike, take it to your dealer before riding it again.

2. Before every ride: Mechanical Safety Check (Section 1.C)

3. After every long or hard ride; if the bike has been exposed to water or grit; or at least every 100 miles: **Clean the bike and lightly lubricate the chain's rollers with a good quality bicycle chain lubricant. Wipe off excess lubricant with a lint-free cloth. Lubrication is a function of climate. Talk to your dealer about the best lubricants and the recommended lubrication frequency for your area. Avoid contaminating the rims with lubricant!**

4. After every long or hard ride or after every 10 to 20 hours of riding:

- Squeeze the front brake and rock the bike forward and back. Everything feel solid? If you feel a clunk with each forward or backward movement of the bike, you probably have a loose headset. Have your dealer check it.
- Lift the front wheel off the ground and swing it from side to side. Feel smooth? If you feel any binding or roughness in the steering, you may have a tight headset. Have your dealer check it.
- Grab one pedal and rock it toward and away from the centerline of the bike; then do the same with the other pedal. Anything feel loose? If so, have your dealer check it.
- Take a look at the brake pads. Starting to look worn or not hitting the wheel rim squarely? Time to have the dealer adjust or replace them.
- Carefully check the control cables and cable housings. Any rust? Kinks? Fraying? If so, have your dealer replace them.
- Squeeze each adjoining pair of spokes on either side of each wheel between your thumb and index finger. Do they all feel about the same? If any feel loose, have your dealer check the wheel for tension and trueness.
- Check the tires for excess wear, cuts or bruises. Have your dealer replace them if necessary.
- check the wheel rims for excess wear, dings, dents and scratches. Consult your dealer if you see any rim damage.

- Check to make sure that all parts and accessories are still secure, and tighten any which are not.
- Check the frame, particularly in the area around all tube joints; the handlebars; the stem; and the seatpost for any deep scratches, cracks or discoloration. These are signs of stress-caused fatigue and indicate that a part is at the end of its useful life and needs to be replaced. See also Appendix B.

WARNING: Like any mechanical device, a bicycle and its components are subject to wear and stress. Different materials and mechanisms wear or fatigue from stress at different rates and have different life cycles. If a component's life cycle is exceeded, the component can suddenly and catastrophically fail, causing serious injury or death to the rider. Scratches, cracks, fraying and discoloration are signs of stress-caused fatigue and indicate that a part is at the end of its useful life and needs to be replaced. While the materials and workmanship of your bicycle or of individual components may be covered by a warranty for a specified period of time by the manufacturer, this is no guarantee that the product will last the term of the warranty. Product life is often related to the kind of riding you do and to the treatment to which you submit the bicycle. The bicycle's warranty is not meant to suggest that the bicycle cannot be broken or will last forever. It only means that the bicycle is covered subject to the terms of the warranty. Please be sure to read Appendix A, Intended Use of your bicycle and Appendix B, The lifespan of your bike and its components, starting on page 35.

5. As required: If either brake lever fails the Mechanical Safety Check (Section 1.C), don't ride the bike. Have your dealer check the brakes.

If the chain won't shift smoothly and quietly from gear to gear, the derailleur is out of adjustment. See your dealer.

6. Every 25 (hard off-road) to 50 (on-road) hours of riding: Take your bike to your dealer for a complete checkup.

B. If your bicycle sustains an impact:

First, check yourself for injuries, and take care of them as best you can. Seek medical help if necessary.

Next, check your bike for damage.

After any crash, take your bike to your dealer for a thorough check. Carbon composite components, including fames, wheels, handlebars, stems, cranksets, brakes, etc. which have sustained an impact *must not* be ridden until they have been disassembled and thoroughly inspected by a qualified mechanic.

See also Appendix B, Lifespan of your bike and its components.

WARNING: A crash or other impact can put extraordinary stress on bicycle components, causing them to fatigue prematurely. Components suffering from stress fatigue can fail suddenly and catastrophically, causing loss of control, serious injury or death.

APPENDIX A

Intended use of your bicycle

WARNING: Understand your bike and its intended use. Choosing the wrong bicycle for your purpose can be hazardous. Using your bike the wrong way is dangerous.

No one type of bicycle is suited for all purposes. Your retailer can help you pick the "right tool for the job" and help you understand its limitations. There are many types of bicycles and many variations within each type. There are many types of mountain, road, racing, hybrid, touring, cyclocross and tandem bicycles.

There are also bicycles that mix features. For example, there are road/racing bikes with triple cranks. These bikes have the low gearing of a touring bike, the quick handling of a racing bike, but are not well suited for carrying heavy loads on a tour. For that purpose you want a touring bike.

Within each of type of bicycle, one can optimize for certain purposes. Visit your bicycle shop and find someone with expertise in the area that interests you. Do your own homework. Seemingly small changes such as the choice of tires can improve or diminish the performance of a bicycle for a certain purpose.

On the following pages, we generally outline the intended uses of various types of bikes.

Industry usage conditions are generalized and evolving. Consult your dealer about how you intend to use your bike.

ALL ADULT SPECIALIZED BICYCLES ARE DESIGNED AND TESTED FOR A MAXIMUM COMBINED RIDER/CARGO/BIKE WEIGHT OF 100KG.

PLEASE VISIT THE OWNER'S MANUAL SECTION OF OUR WEBSITE (WWW.SPECIALIZED.COM) FOR INTENDED USE CATEGORIES AND MODEL-SPECIFIC MAXIMUM WEIGHTS. IN SOME CASES WEIGHT LIMITS ARE HIGHER THAN 100KG.

BIKES CLASSIFIED AND MARKED AS KIDS BIKES (EN 14765) HAVE A MAXIMUM COMBINED RIDER/CARGO/BIKE WEIGHT LIMIT OF 45KG.

High-Performance Road

- **CONDITION 1:** Bikes designed for riding on a paved surface where the tires do not lose ground contact.
- **INTENDED:** To be ridden on paved roads only.
- **NOT INTENDED:** For off-road, cyclocross, or touring with racks or panniers.
- **TRADE OFF:** Material use is optimized to deliver both light weight and specific performance. You must understand that (1) these types of bikes are intended to give an aggressive racer or competitive cyclist a performance advantage over a relatively short product life, (2) a less aggressive rider will enjoy longer frame life, (3) you are choosing light weight (shorter frame life) over more frame weight and a longer frame life, (4) you are choosing light weight over more dent resistant or rugged frames that weigh more. All frames that are very light need frequent inspection. These frames are likely to be damaged or broken in a crash. They are not designed to take abuse or be a rugged workhorse. See also Appendix B.

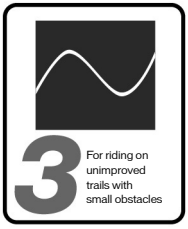
General Purpose Riding

- **CONDITION 2:** Bikes designed for riding Condition 1, plus smooth gravel roads and improved trails with moderate grades where the tires do not lose ground contact.
- **INTENDED:** For paved roads, gravel or dirt roads that are in good condition, and bike paths.
- **NOT INTENDED:** For off-road or mountain bike use, or for any kind of jumping. Some of these bikes have suspension features, but these features are designed to add comfort, not off-road capability. Some come with relatively wide tires that are well suited to gravel or dirt paths. Some come with relatively narrow tires that are best suited to faster riding on pavement. If you ride on gravel or dirt paths, carry heavier loads or want more tire durability talk to your dealer about wider tires.

Cyclo-cross

- **CONDITION 2:** Bikes designed for riding Condition 1, plus smooth gravel roads and improved trails with moderate grades where the tires do not lose ground contact.
- **INTENDED:** For cyclo-cross riding, training and racing. Cyclo-cross involves riding on a variety of terrain and surfaces including dirt or mud surfaces. Cyclo-cross bikes also work well for all weather rough road riding and commuting.
- **NOT INTENDED:** For off road or mountain bike use, or jumping. Cyclo-cross riders and racers dismount before reaching an obstacle, carry their bike over the obstacle and then remount. Cyclo-cross bikes are not intended for mountain bike use. The relatively large road bike size wheels are faster than the smaller mountain bike wheels, but not as strong.

Cross-Country, Marathon, Hardtails



- **CONDITION 3:** Bikes designed for riding Conditions 1 and 2, plus rough trails, small obstacles, and smooth technical areas, including areas where momentary loss of tire contact with the ground may occur. NOT jumping. All mountain bikes without rear suspension are Condition 3, and so are some lightweight rear suspension models.
- **INTENDED:** For cross-country riding and racing which ranges from mild to aggressive over intermediate terrain (e.g., hilly with small obstacles like roots, rocks, loose surfaces and hard pack and depressions). Cross-country and marathon equipment (tires, shocks, frames, drive trains) are light-weight, favoring nimble speed over brute force. Suspension travel is relatively short since the bike is intended to move quickly on the ground.
- **NOT INTENDED:** For Hardcore Freeriding, Extreme Downhill, Dirt Jumping, Slopestyle, or very aggressive or extreme riding. No spending time in the air landing hard and hammering through obstacles.
- **TRADE OFF:** Cross-Country bikes are lighter, faster to ride uphill, and more nimble than All-Mountain bikes. Cross-Country and Marathon bikes trade off some ruggedness for pedaling efficiency and uphill speed.

- **CONDITION 4:** Bikes designed for riding Conditions 1, 2, and 3, plus rough technical areas, moderately sized obstacles, and small jumps.
- **INTENDED:** For trail and uphill riding. All-Mountain bicycles are: (1) more heavy duty than cross country bikes, but less heavy duty than Freeride bikes, (2) lighter and more nimble than Freeride bikes, (3) heavier and have more suspension travel than a cross country bike, allowing them to be ridden in more difficult terrain, over larger obstacles and moderate jumps, (4) intermediate in suspension travel and use components that fit the intermediate intended use, (5) cover a fairly wide range of intended use, and within this range are models that are more or less heavy duty. Talk to your retailer about your needs and these models.
- **NOT INTENDED:** For use in extreme forms of jumping/riding such as hardcore mountain, Freeriding, Downhill, North Shore, Dirt Jumping, Hucking etc. No large drop offs, jumps or launches (wooden structures, dirt embankments) requiring long suspension travel or heavy duty components; and no spending time in the air landing hard and hammering through obstacles.
- **TRADE OFF:** All-Mountain bikes are more rugged than cross country bikes, for riding more difficult terrain. All-Mountain bikes are heavier and harder to ride uphill than cross country bikes. All-Mountain bikes are lighter, more nimble and easier to ride uphill than Freeride bikes. All-Mountain bikes are not as rugged as Freeride bikes and must not be used for more extreme riding and terrain.

- **CONDITION 5:** Bikes designed for jumping, hucking, high speeds, or aggressive riding on rougher surfaces, or landing on flat surfaces. However, this type of riding is extremely hazardous and puts unpredictable forces on a bicycle which may overload the frame, fork, or parts. If you choose to ride in Condition 5 terrain, you should take appropriate safety precautions such as more frequent bike inspections and replacement of equipment. You should also wear comprehensive safety equipment such as a full-face helmet, pads, and body armor.
- **INTENDED:** For riding that includes the most difficult terrain that only very skilled riders should attempt. Gravity, Freeride, and Downhill are terms which describe hardcore mountain, north shore, slopestyle. This is "extreme" riding and the terms describing it are constantly evolving.
- Gravity, Freeride, and Downhill bikes are: (1) heavier and have more suspension travel than All-Mountain bikes, allowing them to be ridden in more difficult terrain, over larger obstacles and larger jumps, (2) the longest in suspension travel and use components that fit heavy duty intended use. While all that is true, there is no guarantee that extreme riding will not break a Freeride bike.
- The terrain and type of riding that Freeride bikes are designed for is inherently dangerous. Appropriate equipment, such as a Freeride bike, does not change this reality. In this kind of riding, bad judgment, bad luck, or riding beyond your capabilities can easily result in an accident, where you could be seriously injured, paralyzed or killed.
- **NOT INTENDED:** To be an excuse to try anything. Read Section 2. F, p. 10.
- **TRADE OFF:** Freeride bikes are more rugged than All-Mountain bikes, for riding more difficult terrain. Freeride bikes are heavier and harder to ride uphill than All-Mountain bikes.

Dirt Jump

- **CONDITION 5:** Bikes designed for jumping, hucking, high speeds, or aggressive riding on rougher surfaces, or landing on flat surfaces. However, this type of riding is extremely hazardous and puts unpredictable forces on a bicycle which may overload the frame, fork, or parts. If you choose to ride in Condition 5 terrain, you should take appropriate safety precautions such as more frequent bike inspections and replacement of equipment. You should also wear comprehensive safety equipment such as a full-face helmet, pads, and body armor.
- **INTENDED:** For man-made dirt jumps, ramps, skate parks other predictable obstacles and terrain where riders need and use skill and bike control, rather than suspension. Dirt Jumping bikes are used much like heavy duty BMX bikes.
- A Dirt Jumping bike does not give you skills to jump. Read Section 2. F, p. 10.
- **NOT INTENDED:** For terrain, drop offs or landings where large amounts of suspension travel are needed to help absorb the shock of landing and help maintain control.
- **TRADE OFF:** Dirt Jumping bikes are lighter and more nimble than Freeride bikes, but they have no rear suspension and the suspension travel in the front is much shorter.

Kids

- Bikes designed to be ridden by children. Parental supervision is required at all times. Avoid areas involving automobiles, and obstacles or hazards including inclines, curbs, stairs, sewer grates or areas near drop-offs or pools.

APPENDIX B

The lifespan of your bike and its components

1. Nothing Lasts Forever, Including Your Bike.

When the useful life of your bike or its components is over, continued use is hazardous.

Every bicycle and its component parts have a finite, limited useful life. The length of that life will vary with the construction and materials used in the frame and components; the maintenance and care the frame and components receive over their life; and the type and amount of use to which the frame and components are subjected. Use in competitive events, trick riding, ramp riding, jumping, aggressive riding, riding on severe terrain, riding in severe climates, riding with heavy loads, commercial activities and other types of non-standard use can dramatically shorten the life of the frame and components. Any one or a combination of these conditions may result in an unpredictable failure.

All aspects of use being identical, lightweight bicycles and their components will usually have a shorter life than heavier bicycles and their components. In selecting a lightweight bicycle or components you are making a tradeoff, favoring the higher performance that comes with lighter weight over longevity. So, If you choose lightweight, high performance equipment, be sure to have it inspected frequently.

You should have your bicycle and its components checked periodically by your dealer for indicators of stress and/or potential failure, including cracks, deformation, corrosion, paint peeling, dents, and any other indicators of potential problems, inappropriate use or abuse. These are important safety checks and very important to help prevent accidents, bodily injury to the rider and shortened product life.

2. Perspective

Today's high-performance bicycles require frequent and careful inspection and service. In this Appendix we try to explain some underlying material science basics and how they relate to your bicycle. We discuss some of the trade-offs made in designing your bicycle and what you can expect from your bicycle; and we provide important, basic guidelines on how to maintain and inspect it. We cannot teach you everything you need to know to properly inspect and service your bicycle; and that is why we repeatedly urge you to take your bicycle to your dealer for professional care and attention.

WARNING: Frequent inspection of your bike is important to your safety. Follow the Mechanical Safety Check in Section 1.C of this Manual before every ride.

Periodic, more detailed inspection of your bicycle is important. How often this more detailed inspection is needed depends upon you.

You, the rider/owner, have control and knowledge of how often you use your bike, how hard you use it and where you use it. Because your dealer cannot track your use, you must take responsibility for periodically bringing your bike to your dealer for inspection and service. Your dealer will help you decide what frequency of inspection and service is appropriate for how and where you use your bike.

For your safety, understanding and communication with your dealer, we urge you to read this Appendix in its entirety. The materials used to make your bike determine how and how frequently to inspect.

Ignoring this WARNING can lead to frame, fork or other component failure, which can result in serious injury or death.

A. Understanding metals

Steel is the traditional material for building bicycle frames. It has good characteristics, but in high performance bicycles, steel has been largely replaced by aluminum and some titanium. The main factor driving this change is interest by cycling enthusiasts in lighter bicycles.

Properties of Metals

Please understand that there is no simple statement that can be made that characterizes the use of different metals for bicycles. What is true is how the metal chosen is applied is much more important than the material alone. One must look at the way the bike is designed, tested, manufactured, supported along with the characteristics of the metal rather than seeking a simplistic answer.

Metals vary widely in their resistance to corrosion. Steel must be protected or rust will attack it. Aluminum and Titanium quickly develop an oxide film that protects the metal from further corrosion. Both are therefore quite resistant to corrosion. Aluminum is not perfectly corrosion resistant, and particular care must be used where it contacts other metals and galvanic corrosion can occur.

Metals are comparatively ductile. Ductile means bending, buckling and stretching before breaking. Generally speaking, of the common bicycle frame building materials steel is the most ductile, titanium less ductile, followed by aluminum.

Metals vary in density. Density is weight per unit of material. Steel weighs 7.8 grams/cm3 (grams per cubic centimeter), titanium 4.5 grams/cm3, aluminum 2.75 grams/cm3. Contrast these numbers with carbon fiber composite at 1.45 grams/cm3.

Metals are subject to fatigue. With enough cycles of use, at high enough loads, metals will eventually develop cracks that lead to failure. It is very important that you read The basics of metal fatigue below.

Let's say you hit a curb, ditch, rock, car, another cyclist or other object. At any speed above a fast walk, your body will continue to move forward, momentum carrying you over the front of the bike. You cannot and will not stay on the bike, and what happens to the frame, fork and other components is irrelevant to what happens to your body.

What should you expect from your metal frame? It depends on many complex factors, which is why we tell you that crashworthiness cannot be a design criteria. With that important note, we can tell you that if the impact is hard enough the fork or frame may be bent or buckled. On a steel bike, the steel fork may be severely bent and the frame undamaged. Aluminum is less ductile than steel, but you can expect the fork and frame to be bent or buckled. Hit harder and the top tube may be broken in tension and the down tube buckled. Hit harder and the top tube may be broken, the down tube buckled and broken, leaving the head tube and fork separated from the main triangle.

When a metal bike crashes, you will usually see some evidence of this ductility in bent, buckled or folded metal.

It is now common for the main frame to be made of metal and the fork of carbon fiber. *See Section B, Understanding composites below.* The relative ductility of metals and the lack of ductility of carbon fiber means that in a crash scenario you can expect some bending or bucking in the metal but none in the carbon. Below some load the carbon fork may be intact even though the frame is damaged. Above some load the carbon fork will be completely broken.

The basics of metal fatigue

Common sense tells us that nothing that is used lasts forever. The more you use something, and the harder you use it, and the worse the conditions you use it in, the shorter its life.

Fatigue is the term used to describe accumulated damage to a part caused by repeated loading. To cause fatigue damage, the load the part receives must be great enough. A crude, often-used example is bending a paper clip back and forth (repeated loading) until it breaks. This simple definition will help you understand that fatigue has nothing to do with time or age. A bicycle in a garage does not fatigue. Fatigue happens only through use.

So what kind of "damage" are we talking about? On a microscopic level, a crack forms in a highly stressed area. As the load is repeatedly applied, the crack grows. At some point the crack becomes visible to the naked eye. Eventually it becomes so large that the part is too weak to carry the load that it could carry without the crack. At that point there can be a complete and immediate failure of the part.

One can design a part that is so strong that fatigue life is nearly infinite. This requires a lot of material and a lot of weight. Any structure that must be light and strong will have a finite fatigue life. Aircraft, race cars, motorcycles all have parts with finite fatigue lives. If you wanted a bicycle with an infinite fatigue life, it would weigh far more than any bicycle sold today. So we all make a tradeoff: the wonderful, lightweight performance we want requires that we inspect the structure.

What to look for

• ONCE A CRACKS STARTS IT CAN GROW AND GROW FAST. Think about the crack as forming a pathway to failure. This means that any crack is potentially dangerous and will only become more dangerous.	SIMPLE RULE 1 : If you find crack, replace the part.
• CORROSSION SPEEDS DAMAGE. Cracks grow more quickly when they are in a corrosive environment. Think about the corrosive solution as further weakening and extending the crack.	SIMPLE RULE 2 : Clean your bike, lubricate your bike, protect your bike from salt, remove any salt as soon as you can.
• STAINS AND DISCOLORATION CAN OCCUR NEAR A CRACK. Such staining may be a warning sign that a crack exists.	SIMPLE RULE 3 : Inspect and investigate any staining to see if it is associated with a crack.
• SIGNIFICANT SCRATCHES, GOUGES, DENTS OR SCORING CREATE STARTING POINTS FOR CRACKS. Think about the cut surface as a focal point for stress (in fact engineers call such areas "stress risers," areas where the stress is increased). Perhaps you have seen glass cut? Recall how the glass was scored and then broke on the scored line.	SIMPLE RULE 4 : Do not scratch, gouge or score any surface. If you do, pay frequent attention to this area or replace the part.

• SOME CRACKS (particularly larger ones) MAY MAKE CREAKING NOISE AS YOU RIDE. Think about such a noise as a serious warning signal. Note that a well-maintained bicycle will be very quiet and free of creaks and squeaks.	SIMPLE RULE 5 : Investigate and find the source of any noise. It may not a be a crack, but whatever is causing the noise should be fixed promptly.

In most cases a fatigue crack is not a defect. It is a sign that the part has been worn out, a sign the part has reached the end of its useful life. When your car tires wear down to the point that the tread bars are contacting the road, those tires are not defective. Those tires are worn out and the tread bar says "time for replacement." When a metal part shows a fatigue crack, it is worn out. The crack says "time for replacement."

Fatigue Is Not A Perfectly Predictable Science

Fatigue is not a perfectly predictable science, but here are some general factors to help you and your dealer determine how often your bicycle should be inspected. The more you fit the "shorten product life" profile, the more frequent your need to inspect. The more you fit the "lengthen product life" profile, the less frequent your need to inspect.

Factors that shorten product life:

- *Hard, harsh riding style*
- *"Hits", crashes, jumps, other "shots" to the bike*
- *High mileage*
- *Higher body weight*
- *Stronger, more fit, more aggressive rider*
- *Corrosive environment (wet, salt air, winter road salt, accumulated sweat)*
- *Presence of abrasive mud, dirt, sand, soil in riding environment*

Factors that lengthen product life:

- *Smooth, fluid riding style*
- *No "hits", crashes, jumps, other "shots" to the bike*
- *Low mileage*
- *Lower body weight*
- *Less aggressive rider*
- *Non-corrosive environment (dry, salt-free air)*
- *Clean riding environment*

WARNING: Do not ride a bicycle or component with any crack, bulge or dent, even a small one. Riding a cracked frame, fork or component could lead to complete failure, with risk of serious injury or death.

B. Understanding composites

All riders must understand a fundamental reality of composites. Composite materials constructed of carbon fibers are strong and light, but when crashed or overloaded, carbon fibers do not bend, they break.

What Are Composites?

The term "composites" refers to the fact that a part or parts are made up of

different components or materials. You've heard the term "carbon fiber bike." This really means "composite bike."

Carbon fiber composites are typically a strong, light fiber in a matrix of plastic, molded to form a shape. Carbon composites are light relative to metals. Steel weighs 7.8 grams/cm3 (grams per cubic centimeter), titanium 4.5 grams/cm3, aluminum 2.75 grams/cm3. Contrast these numbers with carbon fiber composite at 1.45 grams/cm3.

The composites with the best strength-to-weight ratios are made of carbon fiber in a matrix of epoxy plastic. The epoxy matrix bonds the carbon fibers together, transfers load to other fibers, and provides a smooth outer surface. The carbon fibers are the "skeleton" that carries the load.

Why Are Composites Used?

Unlike metals, which have uniform properties in all directions (engineers call this isotropic), carbon fibers can be placed in specific orientations to optimize the structure for particular loads. The choice of where to place the carbon fibers gives engineers a powerful tool to create strong, light bicycles. Engineers may also orient fibers to suit other goals such as comfort and vibration damping.

Carbon fiber composites are very corrosion resistant, much more so than most metals.

Think about carbon fiber or fiberglass boats.

Carbon fiber materials have a very high strength-to-weight ratio.

What Are The Limits Of Composites?

Well designed "composite" or carbon fiber bicycles and components have long fatigue lives, usually better than their metal equivalents.

While fatigue life is an advantage of carbon fiber, you must still regularly inspect your carbon fiber frame, fork, or components.

Carbon fiber composites are not ductile. Once a carbon structure is overloaded, it will not bend; it will break. At and near the break, there will be rough, sharp edges and maybe delamination of carbon fiber or carbon fiber fabric layers. There will be no bending, buckling, or stretching.

If You Hit Something Or Have A Crash, What Can You Expect From Your Carbon Fiber Bike?

Let's say you hit a curb, ditch, rock, car, other cyclist or other object. At any speed above a fast walk, your body will continue to move forward, the momentum carrying you over the front of the bike. You cannot and will not stay on the bike and what happens to the frame, fork and other components is irrelevant to what happens to your body.

What should you expect from your carbon frame? It depends on many complex factors. But we can tell you that if the impact is hard enough, the fork or frame may be completely broken. Note the significant difference in behavior between carbon and metal. See Section 2. A, Understanding metals in this Appendix. Even if the carbon frame was twice as strong as a metal frame, once the carbon frame is overloaded it will not bend, it will break completely.

Inspection of Composite Frame, Fork, and Components

Cracks:

Inspect for cracks, broken, or splintered areas. Any crack is serious. Do not ride any bicycle or component that has a crack of any size.

Delamination:

Delamination is serious damage. Composites are made from layers of fabric. Delamination means that the layers of fabric are no longer bonded together. Do not ride any bicycle or component that has any delamination. These are some delamination clues:

1. A cloudy or white area. This kind of area looks different from the ordinary undamaged areas. Undamaged areas will look glassy, shiny, or "deep," as if one was looking into a clear liquid. Delaminated areas will look opaque and cloudy.

2. Bulging or deformed shape. If delamination occurs, the surface shape may change. The surface may have a bump, a bulge, soft spot, or not be smooth and fair.

3. A difference in sound when tapping the surface. If you gently tap the surface of an undamaged composite you will hear a consistent sound, usually a hard, sharp sound. If you then tap a delaminated area, you will hear a different sound, usually duller, less sharp.

Unusual Noises:

Either a crack or delamination can cause creaking noises while riding. Think about such a noise as a serious warning signal. A well maintained bicycle will be very quiet and free of creaks and squeaks. Investigate and find the source of any noise. It may not be a crack or delamination, but whatever is causing the noise must be fixed before riding.

WARNING: Do not ride a bicycle or component with any delamination or crack. Riding a delaminated or cracked frame, fork or other component could lead to complete failure, with risk of serious injury or death.

C. Understanding components

It is often necessary to remove and disassemble components in order to properly and carefully inspect them. This is a job for a professional bicycle mechanic with the special tools, skills and experience to inspect and service today's high-tech high-performance bicycles and their components.

Aftermarket "Super Light" components

Think carefully about your rider profile as outlined above. The more you fit the "shorten product life" profile, the more you must question the use of super light components. The more you fit the "lengthen product life" profile, the more likely it is that lighter components may be suitable for you. Discuss your needs and your profile very honestly with your dealer.

Take these choices seriously and understand that you are responsible for the changes.

A useful slogan to discuss with your dealer if you contemplate changing components is "Strong, Light, Cheap -pick two."

Original Equipment components

Bicycle and component manufacturers tests the fatigue life of the components that are original equipment on your bike. This means that they have met test criteria and have reasonable fatigue life. It does not mean that the original components will last forever. They won't.

APPENDIX C

Coaster Brake

1. How the coaster brake works

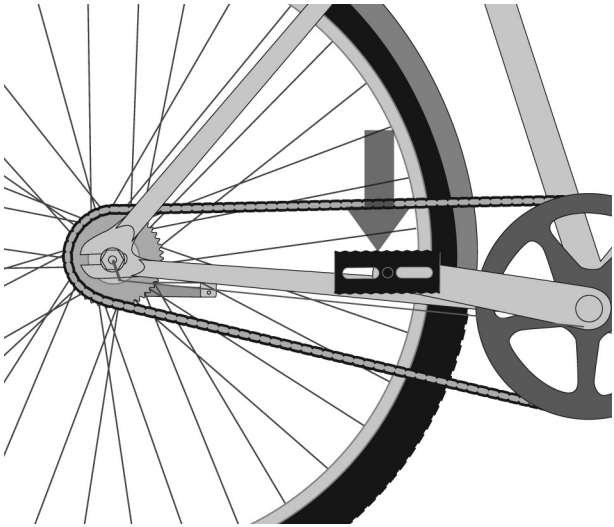
The coaster brake is a sealed mechanism which is a part of the bicycle's rear wheel hub. The brake is activated by reversing the rotation of the pedal cranks (see below). Start with the pedal cranks in a nearly horizontal position, with the front pedal in about the 4 o'clock position, and apply downward foot pressure on the pedal that is to the rear. About 1/8 turn rotation will activate the brake. The more downward pressure you apply, the more braking force, up to the point where the rear wheel stops rotating and begins to skid.

WARNING: Before riding, make sure that the brake is working properly. If it is not working properly, have the bicycle checked by your dealer before you ride it.

WARNING: If your bike has only a coaster brake, ride conservatively. A single rear brake does not have the stopping power of front-and-rear brake systems.

2. Adjusting your coaster brake

Coaster brake service and adjustment requires special tools and special knowledge. Do not attempt to disassemble or service your coaster brake. Take the bicycle to your dealer for coaster brake service.

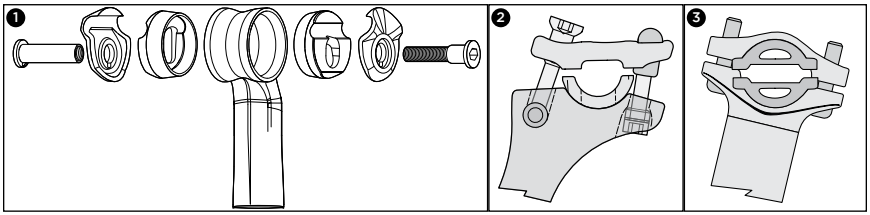


APPENDIX D

Fastener Torque Specifications

Correct tightening torque of threaded fasteners is very important to your safety. Always tighten fasteners to the correct torque. In case of a conflict between the instructions in this manual and information provided by a component manufacturer, consult with your dealer or the manufacturer's customer service representative for clarification. Bolts that are too tight can stretch and deform. Bolts that are too loose can move and fatigue. Either mistake can lead to a sudden failure of the bolt.

Always use a correctly calibrated torque wrench to tighten critical fasteners on your bike. Carefully follow the torque wrench manufacturer's instructions on the correct way to set and use the torque wrench for accurate results.



RECOMMENDED TORQUE VALUES

SEAT POSTS		in-lbf	N*m
Conical wedge (fig.1)	Cobl-Gobl-R / Pave SL / Transition Aero / Shiv Aero / MTN Carbon / Command Post	120	13.6
2-bolt clamp (fig.2)	Non-serrated: S-Works SL/Pro 2-bolt Transition 2-bolt	80	9.0
2-bolt clamp (M6 bolt) (fig.3)	Serrated	100	11.3
1-bolt clamp (M8 bolt)	Generic carbon and alloy posts	210	23.7
	24", 20" Hotrock	110	12.4
Non-integrated clamp	Hotrock 16", Hotrock Coaster	120	13.6
2-bolt clamp - BMX (M8 bolt)		150	16.9
2-bolt clamp (M5 bolt)	Non-serrated (Thomson)	60	6.8
PEDALS		**in-lbf**	**N*m**
Pedal-to-crank interface		304	34.3
FORKS		**in-lbf**	**N*m**
Expander Plug	Specialized 48mm Long Expander Plug	80	9.0
CRANKS		**in-lbf**	**N*m**
S-Works carbon	Spindle center bolt	300	33.9
S-Works carbon	Spider lockring	250	28.2
SRAM/Truvativ	BB30/PF30/GXP spindle	425	48.0
Generic	Square taper spindle	305	34.5
	ISIS spindle	347	39.2
Shimano	Two-sided (Octalink)	305	34.5

CRANKS *(continued)*		in-lbf	N*m
Shimano	Single-sided (non-drive-side pinch attachment)	106	12.0
Shimano	Single-sided with large adjuster nut	392	44.3
Chainring bolts	Alloy	87	9.8
Bottom bracket	Threaded	442	49.9
STEMS		**in-lbf**	**N*m**
Stem @ handlebar (4-bolt)	Carbon or alloy, 31.8mm / 26.0mm / 25.4mm	45	5.1
Stem @ handlebar (2-bolt)	Carbon or alloy, 31.8mm / 26.0mm / 25.4mm	80	9.0
Stem @ steerer tube		45	5.1
Demo stem @ handlebar	31.8mm	45	5.1
Demo stem @ fork clamp		80	9.0
Barmac @ steerer tube	Round clamp	45	5.1
Barmac @ steerer tube	Wedge clamp	110	12.4
BMX stem (adjustable)		210	23.7
E150 stem @ handlebar	4-bolt	90	10.2
E150 stem @ steerer tube		45	5.1
E150 stem @ stanchion tube		75	8.5
E150 lower crown		45	5.1
Quill stem @ steerer tube		160	18.1
Quill stem @ handlebar		80	9.0
Shiv TT stem @ steerer	Time Trial	45	5.1
Shim TT stem @ handlebar	Time Trial	35	4.0
Shiv stem @ handlebar	Triathlon	80	9.0
Shiv stem @ steerer	Triathlon	45	5.1
SHIFTERS / DERAILLEURS		**in-lbf**	**N*m**
Shifter	Mountain	40	4.5
Shifter / Brake lever	Road	70	7.9
Rear derailleur mounting bolt	Road or Mountain	70	7.9
Front derailleur mounting bolt	Road or Mountain, Braze-on or Clamp style	44	5.0
F / R derailleur cable fixing bolt	Road or Mountain	44	5.0
DMD front derailleur bolts	Mountain	40	4.5
SEAT COLLARS		**in-lbf**	**N*m**
Round seat tube collar	27.2mm post	55	6.2
Round seat tube collar	30.9mm post	45	5.1
Aero seat collar	Venge (2-bolt)	50	5.6
Wedge seat collar	Ruby (wedge)	55	6.2
Aero seat collar	Shiv TT (2-bolt)	45	5.1
Aero seat collar	Shiv (2-bolt)	54	5.1
Aero seat collar	Alloy frame, wedge collar, round post	95	10.7
Aero seat collar	Alloy frame, pinch style, aero post	45	5.1
Aero seat collar	Transition (wedge style, aero post)	70	7.9

BRAKES		in-lbf	N*m
Disc brake caliper	IS mount, caliper to adapter bolts (Shimano)	53	6.0
Disc brake caliper	IS mount, caliper to adapter bolts (Hayes)	110	12.4
Disc brake caliper	Post mount bolts (Shimano)	53	6.0
Disc brake caliper	Post mount bolts (Avid, Hayes)	80	9.0
Disc brake rotor	Shimano	35	4.0
Disc brake rotor	Avid	55	6.2
Disc brake rotor	Hayes	50	5.6
Brake lever	Mountain	40	4.5
Shifter / Brake lever	Road	70	7.9
Brake pad	Road	43	4.9
Caliper brake (cable pinch bolt)	Road	52	5.9
Caliper brake (frame/fork bolt)	Road	70	7.9
Rear brake cable stop	Transition rear brake (bolts x 3)	35	4.0
Linear pull brake	Mountain (brake pad bolt, cable pinch bolt)	52	5.9
Linear pull brake (frame/fork bolt)	Mountain	43	4.9
WHEELS		**in-lbf**	**N*m**
Rear axle	142 x 12mm through axle	133	15.0
Front axle	Turbo S, 15mm through axle	105	11.9
Cassette body		261	29.5
Freewheel		261	29.5
Solid nutted axle		200	22.6
MISCELLANEOUS		**in-lbf**	**N*m**
Adjustable dropout	Stumpjumper HT 29" / Rockhopper HT 29"	250	28.2
Bar ends	P1	100	11.3
Bar ends	P2, Targa	80	9.0
Bar ends	S-Works C1 Overendz carbon	85	9.6
Bar ends	S-Works C2 Overendz carbon	50	5.6
Bar end plug	Specialized CNC Alloy Bar End Plug	30	3.4
Derailleur hanger	Alloy bolt, 5mm Allen head	60	6.8
Derailleur hanger	Steel bolt, 4 or 5mm Allen head	80	9.0
Derailleur hanger	Steel bolt, 2.5mm Allen head	10	1.1
Water bottle cage		35	4.0
Handlebar riser bolts	Shiv TT, 4mm Allen head	80	9.0
Handlebar riser bolts	Shiv, 4mm Allen head	100	11.3
Extension clamps @ risers	Shiv, 5mm Allen head	110	12.4
Arm pad brackets	Shiv, 4mm Allen head	40	4.5
Extension clamps @ extensions	Shiv, 4mm Allen head	40	4.5
Arm pads holders	Shiv, 4mm Allen head	40	4.5
Bottom bracket panel	Shiv, 4mm Allen head	25	2.8
Control Tower	Shiv, 4mm Allen head	25	2.8

MISCELLANEOUS *(continued)*		in-lbf	N*m
Brake cable hanger	Tricross	70	7.9
Internal cable routing guides	Bolt-on, 2.5mm Allen head	10	1.1
Bottom bracket cable guide		25	2.8
Carbon saddle rails	Vertical clamp (max applicable top load)	80	9.0
Carbon saddle rails	Horizontal clamp (max applicable side load)	120	13.6
Cantilever brake post	P.Series	53	6.0
Down tube cable guide bat		35	4.0
Headlight	Turbo S	26	2.9
Taillight	Turbo S	9	1.0
Kickstand	Turbo S	89	10.1
Fender mounting bolts		35	4.0

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